(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 904 896 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
31.03.1999 Bulletin 1999/13

(51) Int Cl.[6]: **B24B 45/00**, B24B 23/02, B24D 7/16

(21) Application number: **98307589.6**

(22) Date of filing: **18.09.1998**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **29.09.1997 JP 282659/97**

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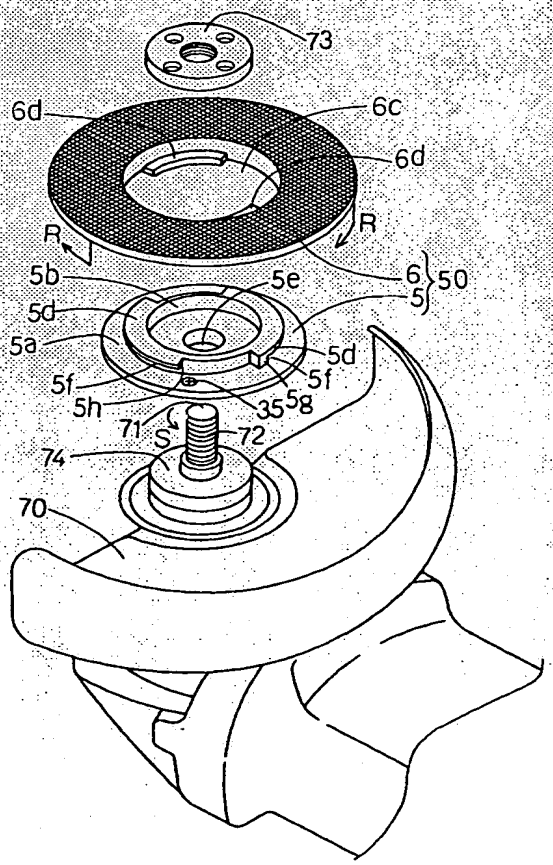
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(54) Rotary grinding jig

(57) The present invention relates to a rotary grinding jig for use with the rotating shaft of a grinder and the like. Said rotary grinding jig comprises a base and a grinding member. The base is composed of a central member adapted to be fixed to the rotating shaft of the grinder and a retaining member for grinding member to be adhesively attached to the grinding member. The central member and the retaining member for grinding member are removably engaged with each other by means of ridges. The central member can be firmly secured to the rotary shaft by fixing screw, and the retaining member for grinding member can be removed with the central member remaining attached to the rotary shaft. If the grinding member wears out, only the retaining member for grinding member and the grinding member may be thrown away for exchange for new ones. Additionally, the retaining member for grinding member may be of a two-piece type; the one member can be repetitively used while the other one may be discarded, so that the residue of members to be discarded can be reduced to a minimum. There are provided a stopper for preventing dissolution of the rotative engagement of the retaining member for grinding member and a means for preventing the retaining member for grinding member from dropping out of the central member.

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Description

Background of the invention

[0001] The present invention relates to a rotary grinding jig for use with the rotating shaft of a rotary drive of a grinder and the like having driving mechanisms of various sorts, in an arrangement such that the rotary grinding jig is firmly secured to said rotating shaft.

[0002] Fig.22 is a central sectional view explanatory of conventional rotary grinding jigs of same type, (A) showing the one before use, and (B) the other one with a worn-out grinding member afte. use.

[0003] This prior art rotary grinding jig comprises a disk-shaped base 100 made of resin or metal and a grinding member 200 stuck to the surface 101 of said base by adhesive.

[0004] The grinding member 200 is composed of a plurality of substantially rectangular grinding cloths 201, ··· 201 overlapped with each other in a radial arrangement.

[0005] Said rotary grinding jig can be fixed to the rotary shaft of the grinder by inserting a rotary shaft of the grinder (not shown), as having a male screw portion formed on the end thereof from below upward into a rotating shaft mounting hole 102 formed in the center of the base, mounting a nut onto the male screw portion of the rotating shaft, and tightening said nut by a clamping tool.

[0006] If the grinding member 200 has worn out, the whole rotary grinding member will be thrown away together with the base 100, as shown in fig.22(B).

[0007] Though not shown here, there exists a rotary grinding jig wherein the base and the grinding member are in close but removable contact with each other by an area fastener.

[0008] As aforementioned, with the conventional rotary grinding jig having the grinding member 200 adhered to the base 100 made of resin or metal, if the grinding member 200 has uselessly worn out, the entire grinding jig must be abolished.

[0009] However, considering that the whole grinding jig must be abolished together with the base, it is feared that this may greatly affect the environment, and besides, this fact is not preferable at all in view of the saving in resources, too. Furthermore, the material cost is also not negligible for manufacturers.

[0010] In case of the exchange of rotary grinding jig, a spent grinding jig is removed from the rotating shaft of the grinder by loosening the nut by a tool, and then, a new grinding jig is mounted onto the rotating shaft of the grinder, the rotating shaft is tightened using the tool again for further fixing the grinding jig thereto. This takes a great deal of troubles and the workability as well as the working efficiency are very bad. On the other hand, there lies a big problem in that with the grinding member and the base removably fixed to each other by area fastener, its mounting strength or fixing strength is poor.

[0011] In this connection, the present invention has for its object the resolution of the above-described problem and for its task the following matters.

[0012] The rotary grinding jig must be so designed that if the grinding member has uselessly worn out, waste portions of the rotary grinding jig may be reduced to a minimum. This may reduce industrial wastes, avoid any adverse influence against the environment, contribute to the saving energy, and lead to a cut in production cost as well.

[0013] A worn-out and useless rotary grinding jig must be exchanged for a new one by a very simple one-touch control. This may execute the exchange of grinding jig simply and in a short time, thus resulting in improvement of the workability and working efficiency.

[0014] Such a one-touch control system for exchange of the grinding jig must not cause any loss of the mounting strength for the grinding jig. The removable fixing by the conventional area fastener cannot assure a sufficient mounting strength, therefore, additional fixing means such as screws for maintaining the strength was used.

[0015] Moreover, there must be provided a means for preventing the grinding jig which has been mounted by a one-touch control from simply coming off its position. That is, a means must be provided for preventing any dissolution of the engagement achieved by such a one-touch control and any possible dropout of the grinding member or retaining member for grinding member of the rotary grinding jig even though the rotary drive of a grinder has stopped all of a sudden.

[0016] Additionally, further task of the present invention is to provide a rotary grinding jig which may be produced by using every type of grinding member, such as grindstone, integral structure of grindstone and resin, abrasive paper, feather cloth, rubber, etc.

Brief summary of the invention

[0017] For the purpose of solving said tasks, a first invention of the present application provides a rotary grinding jig including a disk-like base having a grinding member (2) such as abrasive cloth or grindstone provided on the surface thereof, and a connecting portion (5e) formed in the center thereof so as to be connected with the rotating shaft of a rotary drive, characterized in that the base comprises a retaining member (11) for grinding member provided with the grinding member (2) and a central member (5) having said connecting portion (5e), that said retaining member (11) for grinding member includes a hollow portion (11c) consisting of a through-hole in the center thereof and having a rotative engagement portion (11d) defined on the inner edge portion thereof or close thereto, that the rotative engagement portion (5d) engaged with said rotative engagement portion (11d) is provided on the central member (5), that the rotative engagement portion (11d) of the retaining member (11) for grinding member is adapted to

engage with the rotative engagement portion (5d) of the central member (5) by turning in a direction opposite to the direction in which the rotating shaft of the rotary drive rotates, and that such a resulted engagement is dissolved by turning the rotative engagement portion (11d) in a reverse direction, whereby the rotation of the rotating shaft of the rotary drive may cause further increase of mutual locking between both rotary engagement portions (11d) (5d), that the connecting portion (5e) of the central member (5) consists of a rotating shaft mounting hole, the rotating shaft of the rotary drive is inserted into said connecting portion (5e) so that the central member (5) may be fixed to the rotating shaft of the rotary drive by a fixing means such as nut or bolt, that the outer diameter of said fixing means is made smaller than the inner diameter of the hollow portion (11c) of said retaining member (11) for grinding member, whereby the retaining member (11) for grinding member may be separated with the central member (5) remaining fixed to the rotating shaft.

[0018] As the base is composed of the retaining member 11 for grinding member and the central member 5 as defined separate from each other, if the grinding member 2 has uselessly worn out, only the grinding member 2 and the retaining member 11 for grinding member may be thrown away, while the central member 5 may be left behind for further use, thereby contributing to the environmental protection, saving energy, and cut of production cost.

[0019] The retaining member 11 for grinding and the central member 5 are removably fixed to each other by the rotative engagement portion, so that the both members are easy to engage and disengage.

[0020] Referring to the engagement means of the retaining member 11 for grinding member and the central member 5, since the engagement of the both members is loaded in a direction in which it is further tightened by the rotation of the rotating shaft of the rotary drive, the engagement of the both members will never be dissolved during the grinding operation.

[0021] Because the outer diameter of the fixing means for fixing the central member 5 to the rotating shaft is smaller than the inner diameter of the hollow portion 11c of the retaining member 11 for grinding member, only the retaining member 11 for grinding member and the grinding member 5 may be removed with the central member 5 remaining fixed to the rotating shaft.

[0022] A second invention of the present application provides the rotary grinding jig as defined in the first invention, characterized in that the grinding member 2 and the retaining member 11 for grinding member are hard structures made of grindstones and resin and formed integral with each other.

[0023] The described integrally molded structure of hard quality made of grindstone and resin implies an integral structure produced such as by admixing abrasive powders and abrasive particles with resin, and subjecting the resultant mixture to press molding and sintering.

[0024] As the grinding member and the retaining member 11 for grinding member are formed as an integrally molded structure of hard quality, a separate retaining member 11 for grinding member is not need.

[0025] A third invention of the present application provides the rotary grinding jig as defined in the first invention, characterized in that the retaining member (11) for grinding member is constituted by a first retaining member (11a) positioned in the center side and a second retaining member (11b) positioned in the outside thereof, that said second retaining member (11b) is removably attached to said first retaining member (11a), that the first retaining member (11a) is removably engaged with the central member (5), and that grinding operation may be continued by removing the second retaining member (11b) from the first retaining member (lla) according to the attrition of the grinding member (2).

[0026] In this invention, the base is composed of three members, i.e. the central member, the first retaining member, and the second retaining member, the central member and the second retaining member can be repetitively used, only the worn-out grinding member and the first retaining member are thrown away, the grinding member can be used until it reaches the limit of its usefulness, thus resulting in more diminished quantity of wastes on the abolition of a uselessly worn-out grinding member. This may contribute to the saving resources, the environmental protection, and the cut of production cost as well.

[0027] Furthermore, as the outer peripheral portion (second retaining member) of the base is of a removable type, grinding may be carried out with the grinding member kept strongly pressed on a workpiece to be ground when the outer peripheral portion rests in its position, while the grinding member may be brought into a soft touch with the workpiece in the absence of said outer peripheral portion. This may be most effective for the grinding of curved areas of workpieces.

[0028] A fourth invention of the present application provides the rotary grind jig as defined in the third invention, characterized in that the second retaining member (11b) is retained by the central member (5) on the rear side thereof with the first retaining member (11a) combined thereto.

[0029] In this invention, since the central member can support and maintain the second retaining member on its rear side, the second retaining member can be combined with the first retaining member without any specific engagement means provided between the first and second retaining members.

[0030] A fifth invention of the present application provides the rotary grinding jig as defined in any of the third and fourth inventions, characterized in that engaging portions such as projections (12m) are provided on one of the outer peripheral edge portion of the first retaining member (12a) and the inner peripheral edge portions such as grooves (12n) on the other one, so that the both members may be removably engaged with each other

by engagement means such as said engaging portions and said engaged portions, and said engagement means allow the second retaining member (12b) to cope with an axial force running from the surface side to the rear side.

[0031] In this invention, the engagement means for the first and second retaining members precludes the necessity of support or maintenance by the central member of the second retaining member on its rear side.

[0032] A sixth invention of the present application provides the rotary grinding jig as defined in any of the first to fifth inventions, characterized in that a stopper means (35) that can play vertically is placed in a proper position of the central member (5) for preventing the retaining member (11) for grinding member from turning in a direction in which the engagement of the retaining member (11) for grinding member and the central member (5) is dissolved.

[0033] In this invention, if the rotating shaft of the rotary drive has stopped, the retaining member for grinding member turns in a direction in which the engagement of the retaining member for grinding member and the central member is dissolved, but such a turning can be checked by the stopper means.

[0034] A seventh invention of the present application provides the rotary grinding jig as defined in any of the first to sixth inventions, characterized in that when the retaining member (11) for grinding member turns in a direction in which the engagement of the retaining member (11) for grinding member and the central member (5) is dissolved, a dropout-preventive means is placed in a proper position of the retaining member (11) for grinding member or the central member (5) for preventing the retaining member (11) for grinding member (5) from falling from the central member (5) in the direction of the rotating shaft of the rotary drive.

[0035] In this invention, though if the rotary drive of a grinder has suddenly stopped, the retaining member for grinding member will turn in a direction in which its engagement with the central member (5) is dissolved and then act so as to move in a direction (the direction of the rotating shaft of the rotary drive) in which it separates from the central member, said dropout-preventive means may avoid any possible separation and dropout of the retaining member for grinding member from the central member in the direction of the rotating shaft of the rotary drive.

[0036] A eighth invention of the present application provides a rotary grinding jig comprising a disk-like base fixed to the rotary shaft of the rotary drive of a grinder and a grinding member (2) provided on the surface of said base, characterized in that the base is composed of a central member (8) positioned in the center thereof and an outer peripheral portion (9) positioned on the periphery thereof, that the outer peripheral portion (9) of the base is removably connected with the central member (8), and that grinding operation may be continued by removing the outer peripheral portion (9) from the central member (8) according to the attrition of the grinding member (2).

[0037] In this invention, as the outer peripheral portion of the base is designed to be removable from the central member, even if the grinding member provided on said peripheral portion has worn out into uselessness, the grinding operation can be continued by removing the outer peripheral portion from the central member.

Brief description of the drawings

[0038]

Fig.1 is an exploded perspective view showing a first embodiment of the rotary grinding jig in accordance with the present invention;

Fig.2 is an exploded central longitudinal sectional view of the rotary grinding jig as shown in fig.1;

Fig.3 is a central longitudinal sectional view showing the rotary grinding jig of fig.1 fixed to the rotating shaft of a rotary drive;

Fig.4 shows the central member of the rotary grinding jig as shown in fig.1, (A) being an enlarged perspective view, and (B) a sectional view taken on V - V of fig.4(A);

Fig.5 is an exploded perspective view showing a second embodiment of the rotary grinding jig in accordance with the present invention;

Fig.6 is an exploded central longitudinal sectional view showing a third embodiment of the rotary grinding jig in accordance with the present invention;

Fig.7 is an exploded perspective view explanatory of the rotary grinding jig as shown in fig.6;

Fig.8 shows another embodiment of the central member of the rotary grinding jig in accordance with the present invention, (A) being an enlarged perspective view, and (B) a sectional view taken on V - V of fig.8 (A);

Fig.9 shows the rotary grinding jig of the second embodiment in accordance with the present invention, (A) being a plan view of a grinding member, and (B) a plan view of a central member;

Fig.10 is a plan view showing the engaging relationship between the grinding member and the central member as shown in fig.9, (A) shows the engaging action at work, and (B) shows the state in which a prevention is taken against the dissolution of the engagement of both members;

Fig.11 is an exploded perspective view explanatory of a fourth embodiment of the rotary grinding jig in accordance with the present invention;

Fig.12 is an exploded perspective view showing part of the rotating shaft of a grinder and a fifth embodiment of the rotary grinding jig in accordance with the present invention;

Fig.13 is an exploded central longitudinal sectional view of the embodiment as shown in fig.12;

Fig.14 is a central longitudinal sectional view of the rotary grinding jig fixed to the rotating shaft of the grinder in the embodiment shown in fig.12;

Fig.15 is a perspective view explanatory of the disassembly of all the components of the rotary grinding jig as shown in figs.12 to 14;

Fig.16, showing another embodiment of a retaining member for grinding member in accordance with the present invention, is a perspective view explanatory of first and second retaining members separated from each other, as viewing from the rear side;

Fig.17 is a rear elevation of the retaining member for grinding member with said both members combined with each other;

Fig.18, showing further embodiment of the retaining member for grinding member in accordance with the present invention, is a perspective view explanatory of the first and second retaining members separated from each other, as viewing from the rear side;

Fig.19, showing another embodiment of the retaining member for grinding member in accordance with the present invention, is a perspective view explanatory of the first and second retaining members separated from each other, as viewing from the rear side;

Fig.20, showing another embodiment of the rotary grinding jig in accordance with the present invention, is a perspective view explanatory of the components separated from each other, viewing from the rear side;

Fig.21 is a sectional view explanatory of worn-out rotary grinding jigs in accordance with the fifth embodiment of the present invention as shown in figs. 12 through 14, (A) showing the limit of attrition of a rotary grinding jig with the second retaining member, and (B) showing the limit of attrition of a rotary grinding jig without the second retaining member, and

Fig.22 shows a central longitudinal sectional view of rotary grinding jigs of a conventional type, (A) showing the one before use, and (B) showing the other one with a worn-out grinding member after use.

Detailed description of the preferred embodiment

[0039] The preferred embodiments of the present invention will be described with reference to the accompanying drawings. Figs.1 to 21 show the embodiments of the present invention.

[0040] Figs.1 to 3 show part of the rotating shaft of a grinder as a rotary drive and a first embodiment of a rotary grinding jig in accordance with the present invention, fig.1 being an exploded perspective view, fig.2 an exploded central longitudinal sectional view, and fig.3 a central longitudinal sectional view showing the rotary grinding jig firmly secured to the rotating shaft of the grinder.

[0041] A grinder 70 as illustrated is of an electrically driven type, having a rotating shaft 71 formed with a male thread 72 thereon.

[0042] A rotary grinding jig 50 comprises two separate members such as a central member 5 and a grinding member 6. The central member 5 is made of hard synthetic resin, and the grinding member 6 is produced by sintering a pressed mixture of synthetic resin, abrasive powders and particles.

[0043] Thus, the first embodiment has no retaining member for grinding member intended to support the grinding member 6 from the back face as explained later. It is, of course, readily possible to provide a grinding member 6 bonded with a retaining member for grinding member.

[0044] The numeral 73 designates a fixing screw for fitting on the male threaded portion 72 of the rotating shaft 71, and 74 a packing.

[0045] The central member 5 constituting the rotating grinding jig 50 comprises a disk 5a, a rotating shaft mounting hole 5e serving as a connector for the rotating shaft and formed in the center of the disk 5a, and a short engaging cylindrical portion 5b formed above the disk 5a. Said short engaging cylindrical portion 5b has on its upper periphery extensions 5d serving as a rotary engaging portion with a length equal to a quarter of the circumference and formed in two positions symmetrical about a point. The 5f will be formed in the lower part of the extension 5d. The grinding member 6 constituting another rotary grinding jig 50 is of a disk type, having a hollow portion 6c consisting of a circular through-hole formed in the middle part thereof. The hollow portion 6c has on its lower inner periphery ridges 6d serving as a rotary engaging portion with a length equal to a quarter of the circumference and formed in two positions symmetrical about a point.

[0046] Thus, the central member 5 and the grinding member 6 may be formed integral with each other by putting the groove 5f and the ridge 6d into rotative engagement with each other.

[0047] Specifically, the groove 5f formed in the central member 5 has a terminal portion 5g formed in one end thereof to provide a terminal end of the groove 5f and an opened introducing portion 5h an the other end of the groove 5f. The hollow portion 6c of the grinding member 6 is fitted onto the short engaging cylindrical portion 5b provided with the groove 5f until one end of each ridge 6d abuts on the terminal portion 5g of the groove 5f, as the one end of each ridge 6d is turned to engage with the opened introducing portion 5h of the groove 5f in the central member 5.

[0048] The direction R in which this fitting operation takes place is opposite to the direction S in which the rotating shaft 71 of the grinder 70 is turned. In this connection, when the rotating shaft 71 turns in the direction S for grinding operation, the grinding member 6 is loaded in a direction in which the grinding member 6 is tight-

ened against the central member 5, whereby there is no risk of the grinding member 6 coming off its position.

[0049] The procedure steps for fixing the rotary grinding jig 50 on the rotating shaft 71 of the grinder 70 comprises inserting the rotating shaft mounting hole 5e of the central member 5 into the rotating shaft 71 with the packing 74 interposed between the central member and the rotating shaft, then fitting the fixing screw 73 onto the male screw 72 of the rotating shaft 71, and tightening the fixing screw 73 by means of a tool for locking purpose. Before starting this operation, the central member 5 and the grinding member 6 are joined together.

[0050] Alternatively, first the central member 5 may be mounted on the rotating shaft 71 with the packing 74 interposed between the latter, tightly secured by the fixing screw 73, and then the grinding member 6 may be mounted on the central member 5 in accordance with said engaging procedure.

[0051] If the grinding member 6 has uselessly worn out after the rotary grinding jig 50 had been used for grinding operation, the grinding member 6 can be simply removed out of the central member 5 by turning the grinding member 6 in a direction opposite to the direction R without the necessity of loosening the fixing screw 73 for further removal. Consequently, once the central member 5 has been mounted on the rotating shaft 71, it is unnecessary to carry out any subsequent removal of the fixing screw and fixing operation, and the grinding member 6 can be replaced by a new one with a simple operation.

[0052] The fixing screw 73 may be of an ordinary type, and can be tightly secured by tools such as a wrench.

[0053] In said preferred embodiment, a pin 35 as a stopper member is located near the introduction opening 5h of the groove 5f in the central member 5. This specific pin 35 will be described with reference to fig.4. It is designed to play by gravity in a vertical direction.

[0054] In the grinding operation, the pin 35 may protrude by its weight toward the grinding member 6. At a sudden stop of the grinder, the grinding member 6 will rotate in a direction in which it disengages from the central member 5, but such a rotation is blocked by the protruded pin 35, thereby avoiding displacement of the grinding member 6.

[0055] Fig.4 illustrates the central member 5 which was used in the first preferred embodiment, (A) being an enlarged perspective view, and (B) a sectional view as taken on V-V of fig.4(A). As apparent from those views of drawing, there is provided the pin 35 as a stopper member in the vicinity of the introduction opening 5h of the groove 5f.

[0056] The pin 35 includes large-diameter heads 36, 36 formed in both ends thereof, and a shank having a length larger than that of a hole 5i opened in the disk 5a, by which hole the pin 35 is received with a play. Therefore, the both large-diameter heads 36, 36 of the pin 35 tend to rise and fall under the influence of the gravity.

[0057] That is, in the drawing, the large-diameter head 36 of the pin 35 remains withdrawn with the short engaging cylindrical portion 5b facing upward, and when the rotary grinding jig is in action, the short engaging cylindrical portion 5b is put in a downward position so that the pin 35 protrudes downward.

[0058] When the grinding member is mounted with the short engaging cylindrical portion 5b of the central member 5 facing upward, the pin 35 is not a hindrance to such a mounting operation because the pin is in retreat, and when in use, the pin 35 protrudes downward so as to act as a stopper to prevent the grinding member engaged with the central member 5 from turning for further disengagement.

[0059] The pin 35 may be replaced with a screw having no large-diameter heads on its both ends. In that case, a hole to be opened in the central member 5 must have threads formed thereinside. After the grinding member has been engaged with the central member 5, the head of the screw is turned by a driver for loosening purpose to protrude the screw head from the disk 5a of the central member 5 to such a degree that the screw head may serve as a stopper.

[0060] The reason for the provision of such a stopper member is as follows. Usually, when the grinding operation is terminated and the power for the rotary drive is turned off, the rotating shaft does not stop its motion promptly but gradually reduces its number of revolution until it completely stops. However, in the actual field of operation, often with impatience at waiting for subsequent grinder stop, operators try to bring the grinding member to a sudden stop of revolution by getting the grinding member in touch with other member. In such a case, in the absence of the stopper, a force may act such that the grinding member and the central member will disengage from each other, and the grinding member may leave the central member. Therefore, in accordance with the present invention, in order to avert release of the grinding member from the central member, the pin 35 as a stopper member is provided in the central member 5 in case the grinding member should revolve in a direction in which it disengages from the central member.

[0061] Fig.5 is an exploded perspective view showing part of the rotating shaft of a grinder as a rotary drive and a second embodiment of the rotary grinding jig in accordance with the present invention.

[0062] The illustrated grinder 70 is the same as that of the previous embodiment.

[0063] Though the rotary grinding jig 51 is substantially the same as that of said first embodiment except that it has no stopper pin and that it is provided with a dropout-preventive means. The central member 5 constituting the rotary grinding jig 51 comprises a disk 5a, a rotating shaft mounting hole 5e serving as a connector for the rotating shaft and formed in the center of the disk 5a, and a short engaging cylindrical portion 5b formed above the disk 5a. Said short engaging cylindrical por-

tion 5b has on its upper periphery extensions 5d serving as a rotary engaging portion with a length equal to a quarter of the circumference and formed in two positions symmetrical about a point. A long groove 5f is formed in the lower part of the extension 5d.

[0064] The groove 5f has a terminal portion 5g formed in one end thereof to provide a terminal end of the groove 5f and an opened introducing portion 5h in the other end of the groove 5f.

[0065] The grinding member 6 constituting another rotary grinding jig 51 is of a disk type, having a hollow portion 6c consisting of a circular through-hole formed in the middle part thereof. The hollow portion 6c has on its lower inner periphery ridges 6d serving as rotative engaging portion with a length equal to a quarter of the circumference and formed in two positions symmetrical about a point.

[0066] Furthermore, in this preferred embodiment, these two ridges 6d each have a notch 6k formed substantially in the middle thereof, while locking projections 5k are respectively formed between the extensions 5d, 5d which are provided on the short engaging cylindrical portion 5b of the central member 5.

[0067] Each of the locking projections 5k provided on the central member 5 is a dropout-preventive means, which can prevent the grinding member 6 from dropping out of the central member 5 axially of the rotating shaft.

[0068] The procedure steps of making an engagement between the grinding member 6 and the central member 5 comprises aligning the notches 6k of the ridges 6d of the grinding member 6 with the position of the locking projections 5k of the central member 5, fitting a hollow portion 6c of the grinding member 6 onto the short engaging cylindrical portion 5b of the central member 5, and engaging one end of the ridges 6d into the introducing portion 5h of the groove 5f in the central member 5 as the ridge 6d is gradually turned in the direction R together with the disk 5a abutting the ridge 6d until the ridge 6d gets in touch with the terminal portion 5g of the groove 5f.

[0069] If the grinder stops with the grinding jig kept in touch with an object to be ground, the grinding member 6 may turn in a direction (as opposed to the direction R) in which disengagement takes place. In that case, said locking projections 5k as dropout-preventive means is operable to prevent the grinding member 6 from separating from the central member 5 axially of the rotating shaft 71 of the grinder by the arrangement such that the end of the ridge 6d is abutted against the terminal portion 5g of the other groove 5f to put the notch 6k and the locking projection 5k in separate positions. This will be further specified afterwards.

[0070] The described numbers of the extensions 5d and locking projections 5k being provided on the central member 5 and the described numbers of the ridges 6d and notches 6k being provided on the grinding member 6 are by way of example, and any number may freely be selected.

[0071] The procedure for fixing the rotary grinding jig 51 on the rotating shaft 71 of the grinder 70 is the same as in the above-mentioned embodiment.

[0072] If the grinding member 6 has uselessly worn out after the rotary grinding jig 51 had been used for grinding operation, the grinding member 6 can be simply removed out of the central member 5 by turning the grinding member 6 in a direction opposite to the direction R for rotative engagement without the necessity of loosening the fixing screw 73 for further removal so as to put the notches 6k in the position of the locking projections 5k.

[0073] Consequently, once the central member 5 has been mounted on the rotating shaft 71, it is unnecessary to carry out any subsequent removal of the fixing screw and fixing operation, and the grinding member 6 can be exchanged for a new one with a simple operation.

[0074] Figs.6 and 7 illustrate a third preferred embodiment in accordance with the present invention, fig. 6 being a substantially central longitudinal sectional view showing a retaining member 11 for grinding member to which a grinding member 2 is attached, and a central member 5, which members being in separate positions, and fig.7 an exploded perspective view explanatory of the retaining member 11, the grinding member 2 unattached to the former, and the central member 5.

[0075] Unlike in the previous embodiment, a base 1 is constituted by the retaining member 11 for grinding member and the central member 5, both the components being made of hard resin.

[0076] The retaining member 11 for grinding member is of a disk type, including a hollow portion 11c consisting of a circular through-hole. The retaining member 11 for grinding member has the grinding member 2 bonded by an adhesive 22 to the surface 11f thereof.

[0077] The grinding member 2 consists of a plurality of grinding cloths 21 ··· 21. Each of the grinding cloths 21 ··· 21 is a small segment of a substantially rectangular or fan-like shape. The grinding cloth so called here includes cloth smeared with abrasive powders as well as paper daubed with abrasive powders. The cloths 21 are adhesively arranged in a radial pattern on the retaining member 11 for grinding member in a manner that adjacent grinding cloths lean against each other, namely they lean toward the surface of the retaining member 11 for grinding member.

[0078] More specifically, the grinding cloths 21 are adhesively attached to the surface 11f of the retaining member 11 for grinding member coated with adhesive 22 so that they will overlap with each other with a tubular or radial arrangement. Pressure is applied to the grinding cloths, while the adhesive 22 is dried.

[0079] The hollow portion llc of the retaining member 11 for grinding member has on its inner periphery ridges 11d serving as a rotary engaging portion with a length substantially equal to a quarter of the circumference and formed in two positions symmetrical about a point. This arrangement of ridge 11d is the same as that of the ridge

6d provided on the grinding member 6 in the second embodiment, the ridges 11d each having a notch 11k formed substantially in the middle thereof.

[0080] The central member 5 is substantially the same as the counterpart in the second embodiment, including a disk 5a, a short engaging cylindrical 5b provided on the disk 5a, and a flange-like portion 5c laterally extending from the side edge.

[0081] The disk 5a has an outer diameter that is smaller than that of the retaining member 11 for grinding member but larger than the inner diameter of the hollow portion 11c of the retaining member 11 for grinding member.

[0082] The disk 5a has a rotating shaft mounting hole 5e formed in the center thereof so as to serve as a connector to connect with the rotating shaft of the rotary drive. The rotating shaft mounting hole 5e is a circular hole extending through the disk 5a and having an inner diameter substantially equal to the outer diameter of the rotating shaft (not shown) of the rotary drive. The disk 5a may be firmly secured to said rotating shaft by fitting and securely mounting the rotating shaft mounting hole 5e on the rotating shaft by a fixing means, as illustrated in the second embodiment.

[0083] The short engaging cylindrical portion 5b is of a substantially cylindrical type, concentric with the disk 5a, and having a groove 5f formed on the outer periphery thereof to serve as a rotary engaging portion for engaging with the ridge lld formed in the hollow portion 11d of the retaining member 11 for grinding member.

[0084] The arrangement of the groove 5f is the same as that in the second embodiment. The short engaging cylindrical portion 5b has on its upper outer periphery extensions 5d having a length substantially equal to a quarter of the peripheral length and formed symmetrically on two points. The long groove 5f is formed in the lower part of the extension 5d, having a terminal portion 5g formed in one end thereof to provide a terminal end of the groove 5f and an opened introducing portion 5h in the other end thereof.

[0085] There is provided an locking projection 5k between the extensions 5d. The locking projection 5k may act as a dropout-preventive means, so that it can prevent the retaining member 11 for grinding member from dropping from the central member 5, as in the second embodiment.

[0086] The flange-like portion 5c is equal to or smaller than the retaining member 11 of grinding member in outer diameter.

[0087] The engaging of the central member 5 with said retaining member 11 for grinding member is achieved in the same manner as that of the second embodiment.

[0088] The above-described arrangement makes it possible to mount or dismount said retaining member 11 for grinding member on or from the central member 5 as it remains firmly fixed to the rotating shaft of the rotary drive. Therefore, if the grinding member 2 has worn out to uselessness, the retaining member 11 for grinding member can be simply exchanged for another one provided with a new grinding member 2.

[0089] With the central member 5 and the retaining member 11 for grinding member remaining engaged with each other, the flange-like portion 5c is abutted by its surface 5j on the rear side 11j of the retaining member 11 for grinding member. This may push back a force applied from the grinding member 2 backward, whereby the shape of the grinding member 2 can be safely maintained in the grinding operation. Thus, thanks to the existence of the flange-like portion 5c, the retaining member 11 for grinding member destined to be thrown away together with the grinding member 2 may be made thinner.

[0090] The bonding between the central member 5 and the retaining member 11 for grinding member can be strengthened by increasing the frictional resistance between the both members by rendering the surface 5j of the flange-like portion 5c of the central member 5, or the rear side of the retaining member 11 for grinding member, or both properly raised and depressed.

[0091] Fig.8 shows the central member 5 used in the second and third embodiments and having an additional stopper member, (A) being an enlarged perspective view, and (B) a sectional view taken on V - V of (A).

[0092] As apparent from the drawing, there is provided a pin 35 near the introducing portion 5h of the groove 5f. This pin 35 serves as a stopper member. The pin 35, which is the same one as shown in the first embodiment, has large-diameter heads 36, 36 formed in both ends thereof, a shank with a length larger than the length of a hole 5i opened in the disk 5a, by which hole the pin 35 is received with a play. Therefore, the both large-diameter heads 36, 36 of the pin 35 tend to rise and fall under the influence of the gravity. That is, in the drawing, the large-diameter head 36 of the pin 35 remains withdrawn with the short engaging cylindrical portion 5b facing upward, and when the rotary grinding jig is in action, the short engaging cylindrical 5b faces downward (i.e. the grinding member faces downward) so that the pin 35 protrudes downward.

[0093] When the grinding member is rotationally mounted with the short engaging cylindrical portion 5b of the central member 5 facing upward, the pin 35 is not a hindrance to such a mounting operation because the pin is in retreat, and when in use (as with the grinding member facing downward), the pin 35 protrudes downward so that either the grinding member 6 engaged with the central member 5 or the retaining member 11 for grinding member can be prevented from turning in a direction in which any of the members will be displaced.

[0094] A screw may be substituted for this pin 35, as in the first embodiment.

[0095] By employing such a stopper, the grinding member 6 or the retaining member 11 for grinding member can be prevented from turning in the direction of disengagement even if the rotating shaft has made a sud-

den stop.

[0096] In this embodiment, the locking projections 5k serving as a dropout-preventive means may avoid any dropout of the grinding member 6 or the retaining member 11 for grinding member in an axial direction of the rotating shaft of the grinder.

[0097] Accordingly, in the embodiment as shown in fig.8, the combination of the dropout-preventive means and the stopper member may perform a double function of stopper.

[0098] Figs.9 and 10 illustrate the relation between the locking projection 5k and the notch 6k in the second embodiment. Fig.9(A) is a plan view of grinding member 6 and fig.9(B) is a plan view of the central member 5.

[0099] As already explained, on the inner periphery of the hollow portion 6c consisting of a through-hole in the middle of the grinding member 6, two ridges 6d each protruding centrally of said hole and having a length equal to a quarter of the circumference are disposed respectively in the positions symmetrical about a point. Each ridge 6d has a notch 6k formed in the middle thereof.

[0100] On the other hand, the short engaging cylindrical portion 5b of the central member 5 has extensions 5d extending from the upper edge outward, and a groove 5f is formed in the lower part of the extension 5d, having an introducing portion 5h in one end thereof and a terminal portion 5g in the other end. The extensions 5d each having a length equal to a quarter of the circumference are also provided in two positions symmetrical about a point. The respective locking projections 5k serving as dropout-preventive means are provided between the respective extensions 5d.

[0101] Fig.10(A) is a plan view showing the combination of the hollow portion 6c formed in the middle of the grinding member 6 and the short engaging cylindrical portion 5b of the central member 5.

[0102] As apparent from this drawing, the hollow portion 6c of the grinding member 6 may be combined with the short engaging cylindrical portion 5b of the central member 5 by fitting the locking projections 5k of the central member 5 into the notches 6k of the grinding member 6.

[0103] Then, by turning the grinding member 6 in the direction of arrow R, the ridges 6d are gradually inserted into the grooves 5f of the central member 5 until the former get in contact with the terminal portions 5g of the grooves 5f, thus resulting in the complete engagement of the grinding member 6 in the central member 5.

[0104] Fig.10(B) is an explanatory view showing the state in which the ridges 6d of the grinding member 6 and the grooves 5f of the central member 5 disengage from each other as in the event that in operation, a sudden stop of the rotary drive due to a power cut has been made while the grinding member and the object being ground are kept in contact with each other.

[0105] In the grinding operation, the rotary grinding jig in accordance with the present invention is driven by the rotary drive to turn in the direction of arrow S, and if the rotary drive suddenly stops, the grinding member 6 only continues turning relatively in the direction of arrow S in accordance with the law of inertia. That is, the grinding member 6 only rotates in a direction (the direction of arrow S) in which the engagement with the central member 5 is dissolved. The grinding member 6 stops its rotary motion just when one end of the ridge 6d collides against the terminal portion 5g of one groove 5f after the ridge 6d has separated from the other groove 5f. In this case, the terminal portion 5g acts as a rotation stopping portion to discontinue the rotation of the ridge 6d. Fig. 10(B) illustrates this matter.

[0106] Positioning of the notches 6k of the grinding member 6 and the locking projections 5k of the central member 5 is carried out in advance such that these components may get slightly out of position with each other in the described situation. Such a positional relation enables the locking projections 5k to function as a dropout-preventive means.

[0107] In order that the grinding member 6 and the central member 5 are engaged with each other, preliminary positioning of the both members is achieved so that the notches 6k may meet with the locking projections 5k for such further engagement.

[0108] Generally speaking, said preliminary procedure is intended for the arrangement such that the locking projections 5k and the notches 6k may meet each other in position, not at the time when but before the ends of the ridges 6d of the grinding member 6 are abutted against the terminal portion 5g of the central member 5 serving as a rotation stopping portion by means of the grinding member 6 which turns in the direction in which the engagement with the central member 5 is dissolved, as in case the grinder has stopped during the grinding operation.

[0109] The provision of the notches 6k and the locking projections 5k as dropout-preventive means allows avoidance of separation or dropout of the grinding member of the grinding jig or the retaining member for grinding member from the central member if the rotary grinding jig is handled as it stands facing upward or in an upright position.

[0110] Furthermore, the addition of said pin 35 as a stopper member may realize a double function of stopper, so that even though the rotary grinding jig in accordance with the present invention faces in whatever direction when in use, namely downward, upward, or upright, there is no risk of the grinding member or the retaining member for grinding member separating or dropping out of the central member.

[0111] The said arrangement of the notches 6k and the locking projections 5k may be properly changed in design.

[0112] For example, said separation or dropout can also be avoided without notches 6k provided on the ridges 6d of the grinding member 6. In that case, the ridge 6d is made about half as long as the described embod-

iments, and the locking projection 5k is made extending long in the peripheral direction of the short engaging cylindrical portion 5b of the central member 5. Such a structure may cause the ridge 6d to take up its position under the locking projection 5k when the ridge 6d is in contact with the terminal portion 5g of one groove 5f serving as a rotation stopping portion after the disengagement from the other groove 5f of the central member 5. This enables the grinding member 6 to escape dropout from the central member 5.

[0113] That is to say, the ridge 6d may be designed such that it stops in a position under the locking projection 5k of the central member 5 after the central member 5 has disengaged from the groove 5f. This may enable the locking projection 5k to discharge its function as a dropout-preventive means.

[0114] Referring to fig.9, projections may be provided in the positions of the notches 6k of the ridges 6d of the grinding member 6 instead of both the locking projections 5k and notches 6k, while with the exclusion of the terminal portions 5g from the extensions 5d of the central member 5 may remain only grooves 5f under the extensions 5d.

[0115] In such a case, the engagement of the grinding member 6 and the central member 5 may be achieved by putting notches 6x, 6x between the ridges 6d of the grinding member 6 and the extensions 5d, 5d of the central member 5 together to combine the both members, then turning them in the direction R, and abutting said projections, as rotation stopping portion, of the ridges 6d of the grinding member 6 against the end of the extensions 5d.

[0116] If the grinder stops in operation, the grinding member 6 turns in the direction (opposite to the direction R) in which the engagement with the central member 5 is dissolved, and the ridge 6d disengages from one extension 5d, and engages with the other extension 5d in turn so that the projection formed in the substantially middle part of the ridge 6d for serving as rotation stopping portion may abut against the end portion of this extension 5d, with the result that this extension 5d can discharge its function as dropout-preventive means.

[0117] Fig.11 is an exploded perspective view showing a fourth embodiment of the present invention.

[0118] Also in this embodiment, the base does not possess any retaining member for grinding member, and represents a central member 30. As shown in this drawing, a short engaging cylindrical portion 30b of the central member 30 includes not groove but four projections 30d spaced on the outer periphery m for serving as rotative engagement portion instead.

[0119] On the other hand, there are formed four receiving grooves 40d which are similarly spaced on the inner periphery n of the hollow portion 40a constituted by a circular through-hole in a grinding member 40, said receiving grooves 40d being disposed in the positions to which they have retreated from the rear side 4c along the direction of insertion A and opened in the peripheral direction of the inner periphery n. These receiving groove 40 each are another rotative engagement portions.

[0120] Each receiving groove 40d has an introducing portion 40e extending in the direction of insertion A, and a retaining portion 40f extending in the peripheral direction B of the inner periphery n of the hollow portion 40a.

[0121] The combination of the grinding member 40 with the central member 30 is conducted by the following procedure steps; the hollow portion 40a of the grinding member 40 is inserted into the short engaging cylindrical portions 30b by plugging the projections 30d ··· 30d from the rear side 40c of the grinding member 40 into the introducing portions 40e ··· 40e of the receiving grooves 40d ··· 40d, and furthermore, in order to insert the projections 30d ··· 30d into the retaining portion 40f ··· 40f of the receiving grooves 40d ··· 40d, either the central member 30 is turned peripherally relative to the grinding member 40, or the grinding member 40 is turned peripherally relative to the central member 30, whereby the projections 30d are turned relatively in said peripheral direction B until the projections 30d may be engaged in the receiving grooves 40d to such an extent that the projections 30d get in touch with the end of the retaining portions 40f.

[0122] The engagement process for the central member 30 and the grinding member 40 has been completed as in the above-described manner. The disengagement of the grinding member 40 from the central member 30 may be done in the procedure reverse to the above.

[0123] Additionally, in this embodiment, each of the receiving grooves 40d of the grinding member 40 includes a locking groove 40k formed peripherally opposite to the retaining portion 40f and extending from the introducing portion 40e. Such a locking groove 40k may act as dropout-preventive means to prevent the grinding member 40 from slipping out of the central member 30.

[0124] The function of the locking grooves 40k as dropout-preventive means is as follows. For example, if the rotary drive happened to stop its motion in the grinding operation, the grinding member 40 turns in the direction (opposite to the illustrated direction of arrow B) in which the engagement with the central member 30 is released. Then, the projections 30d of the central member 30 each run from the retaining portions 40f of the receiving grooves 40d and past the introducing portions 40e into contact with the terminal ends (rotation stopping portion) of the locking grooves 40k, in said contact, the projections 30d and the introducing portions 4e of the receiving grooves 40d do not meet each other so that the projections 30d may be prevented from falling from the introducing portions 40e.

[0125] The peripheral length of the locking groove 40k serving as dropout-preventive means may be set in a proper manner.

[0126] There are provided four projections 30d and receiving grooves 40d respectively in this embodiment, but this number may be properly changed. The retaining

portion 40f of the receiving groove 40d may be made gradually narrower in width, or a tiny projection may be provided inside the retaining portion 40f for serving as slippage-preventive means to ensure that the projections 30d will be maintained within the retaining portion 40f.

[0127] Many different types of dropout-preventive means have been described. All they have to do is to have an arrangement based on the following structure. A ridge or projection is provided in any one of the inner periphery of the grinding member or the hollow portion of the retaining member for grinding member and the outer periphery of the short engaging cylindrical portion of the central member, and grooves in the other one so as to enable the rotative engagement of the both members. If the grinding member turns in the direction of disengagement opposite to that of rotative engagement, and the ridge provided in said inner periphery or outer periphery abuts against the rotation stopping portion, the ridges and the notches do not get into positional agreement with each other to avoid any dropout of the grinding member or the retaining member for grinding member when some of them has disengaged from the central member.

[0128] The concrete means for preventing dropout is the combination of said notch 6k and locking projection 5k (the first to third embodiments), and the combination of said projection 30d and locking groove 40k (the fourth embodiment). Other dropout-preventive means can be embodied by said notches 6x and extensions 5d (with no terminal portion), and additional rotation stopping portion placed in a suitable position.

[0129] Four preferred embodiments in accordance with the present invention have been described so far. In the present invention, the rotary grinding jig consists of three components such as central member, retaining member for grinding member, and grinding member. Of all the members, the retaining member for grinding member and the grinding member may be formed integral with each other, or the retaining member for grinding member and the central member may be formed integral with each other. In short, it is preferable that the retaining member for grinding member and the grinding member, or only the grinding member be removably attached to the central member.

[0130] For this purpose, the maximum outer diameter of the fixing means such as a fixing screw of securing the central member to the rotational shaft of the rotary drive must be smaller than the inner diameter of the through-hole (hollow portion) formed in the middle of the removable retaining member for grinding member or the grinding member. This makes it possible for the retaining member for grinding member or the grinding member to be removed from the central member as the latter remains fixed to the rotational shaft.

[0131] Examples of other removably fixing means than can be employed are various kinds of mechanical engagement means such as the rotative engagement of ridges and grooves, the rotative engagement of projections and receiving grooves, etc.

[0132] The rotative engagement portion provided on the inner edge of the through-hole (hollow portion) of the grinding member or retaining member for grinding member may not always be disposed in a site of the inner edge but on a part of the joint area for the central member near the inner edge.

[0133] In accordance with the present invention, there are provided additional stopper member and dropout-preventive means to avoid any possible separation or disengagement of the central member, and the grinding member or the retaining member for grinding member from each other when the rotative engagement of the both members takes place. The stopper member is adapted to prevent the grinding member or the retaining member for grinding member from turning in the direction of disengagement on the plane normal to the direction of the rotational shaft, while the dropout-preventive means acts to prevent the grinding member or the retaining member for grinding member from separating from the central member in a direction in which the rotational shaft extends.

[0134] Figs. 12 to 14 illustrate some of the rotating shaft of a grinder as rotary drive and a fifth embodiment of the rotary grinding jig in accordance with the present invention, fig. 12 being an exploded perspective view, fig. 13 an exploded central longitudinal sectional view, and fig. 14 a central longitudinal sectional view of the rotary grinding jig firmly attached to the rotating shaft of the grinder. The fifth embodiment is substantially the same as the third embodiment in the rotary grinding jig except that the retaining member for grinding member is composed of two pieces.

[0135] In figs. 13 and 14, for easier observation sake, the thickness, a characteristic portion, of the retaining member for grinding member is illustrated thicker than it actually should be, and uniform as well, but the actual thickness is thinner than the illustrated, in the order of 2 to 3 mm, and designed so as to become gradually thinner from the inside to the outside (this applies to the other figures of drawing showing the embodiments of the present invention).

[0136] This specific rotary grinding jig comprises a central member 5 to be fixed to the rotary shaft 71 of the grinder, a retaining member 11 for grinding member to be removably engaged with said central member, and a grinding member 2 to be bonded to the surface of said retaining member 11 for grinding member. As apparent not from fig. 12 but figs. 13 and 14, said retaining member 11 for grinding member is composed of two pieces such as a first retaining member 11a positioned in the center and a second retaining member 11b positioned in the outside thereof. Thus, in this embodiment, the base of the rotary grinding jig is constituted by three parts, i.e. the central member 5, the first retaining member lla, and the second retaining member 11b; it may be compared to a three-piece article. This may apply to another em-

bodiments as illustrated in subsequent figures of drawing as far as fig.19.

[0137] The central member 5 and the retaining member 11 for grinding member are made of hard synthetic resin. The grinding member 2 consists of substantially rectangular grinding sheets 21, 21 ... such as sand paper are slightly staggered so as to coincide in part with each other in radial arrangement. The grinding member 2 is glued by adhesive to the surface of the first retaining member IIa in the center of the retaining member 11 for grinding member but not to the second retaining member. Incidentally, the central member 5 and the retaining member 11 for grinding member may be made of metal.

[0138] In figs.13 and 14, section IIs shown by a bold solid line designates an adhesive joint.

[0139] The foregoing configuration allows the grinding member 2 to continue grinding operation following the process that overlapped abrasive materials manifest themselves in part gradually as the grinding operation goes on, in other words, as an upper grinding sheet wear down, a lower grinding sheet appears. Any other types of grinding members are usable, but said grinding sheet such as sand paper, or an unwoven cloth incorporated with abrasive materials and having the shape of a disk and a desired thickness wherein the abrasive materials emerge from inside as said unwoven cloth wears out is particularly available.

[0140] The numeral 73 identifies a fixing screw threadly engaging onto the male threaded portion 72 of the rotating shaft 71, and 74 a packing.

[0141] The structure of the central member 5 is the same as that in the third embodiment (as shown in figs. 6 and 7).

[0142] The structure of the inner peripheral portion of the hollow portion IIc consisting of a circular through-hole in the middle of the first retaining member IIa of the retaining member 11 for grinding member which is removably engageable with the central member 5 is also the same as that of the third embodiment.

[0143] In this connection, the fifth embodiment provides a dropout-preventive means for preventing the retaining member 11 for grinding member from dropping out of the central member 5. Moreover, pin 35 may be used as stopper member.

[0144] The procedure steps for fixing the rotary grinding jig on the rotating shaft 71 of the grinder 70 comprises engaging the central member 5 with the retaining member 11 for grinding member having the grinding member 2 adhesively attached thereto, fitting the rotating shaft mounting hole 5e of the central member 5 onto the rotating shaft 71 with the packing 74 disposed therebetween, and then threadly engaging the fixing screw 73 onto the male threaded portion 72 of the rotating shaft 71 for further tight fitting by tool.

[0145] Alternatively, after only the central member 5 has been mounted on the rotating shaft 71 with the packing 74 interposed between them into tight fitting by the fixing screw 73, the retaining member 11 for grinding member may be mounted on the central member 5 in accordance with said procedure steps.

[0146] It is essential that the maximum outer diameter of the fixing screw 73 be smaller than the minimum inner diameter of the retaining member 11 for grinding member. This permits removal of the retaining member 11 for grinding member from the central member 5 with the central member 5 remaining firmly fitted on the rotating shaft of the rotary drive of a grinder.

[0147] Both the first and second retaining members 11a, 11b of the retaining member 11 for grinding member are not fixed but only connected with each other by joining the outer periphery of one of the members to the inner periphery of the other one through steps 11h provided on the respective peripheries (see figs.13 and 14), but there is no risk of the second retaining member IIb positioned in the outside coming off because it is held with the grinding member 2 and the central member 5, while positioned between the latter, as described afterward.

[0148] In the grinding operation using this rotary grinding jig, if the grinding member 2 wears out and its outer periphery gets substantially equal to the outer diameter of the second retaining member 11b of the retaining member 11 for grinding member, such a resulted outer periphery is no longer useful for further grinding.

[0149] In the present invention, this is indeed the time when the second retaining member 11b in the outside of the retaining member 11 for grinding member may be removed.

[0150] If the retaining member 11 for grinding member provided on the grinding member is turned in the direction of arrow S as shown in fig.12 to remove it from the central member 5, then the second retaining member IIb is ready to be simply removed from the first retaining member IIa, and if need be, the grinding operation can be resumed by mounting a retaining member for grinding member formed with first retaining member 11a only on the central member 5.

[0151] This is because the grinding member 2 is still capable of continuing the grinding operation without the second retaining member 11b mounted on the rear side of the periphery of the grinding member 2 until the attrition of the grinding member 2 develops close to the outer periphery of the first retaining member 11a. This matter will be discussed in detail later.

[0152] If the grinding member 2 finally becomes unusable, it is not necessary at all to loosen the fixing screw 73 to remove the central member 5. The worn grinding member 2 and the first retaining member 11a only are turned in the direction opposite to the direction of rotative engagement R so as to bring the notches 11k of the first retaining member IIa and the locking projections 5k of the central member 5 into positional agreement with each other. Then, the first retaining member 11a may be simply removed from the central member 5 and abolished accordingly.

[0153] Thus, once the central member 5 has been

mounted on the rotating shaft 71, exchange for another retaining member 11 for grinding member provided with a new grinding member 2 can be simply performed without the necessity of removing the fixing screw and conducting any fixing operation.

[0154] The second retaining member 11b in the outside of the retaining member 11 for grinding member can also be used again and again just like the central member 5.

[0155] The process for fixing the rotary grinding jig on the rotating shaft 71 of the grinder 70 may be made in the following manner. To begin with, the central member 5 is mounted on the rotating shaft 71 with the packing 74 interposed between them, threadly engaging the fixing screw 73 on the rotating shaft 71 by hand, tightening the fixing screw 73 by turning it by means of a tooling until the central member 5 can be fully secured to the rotating shaft 71. Thereafter, the retaining member 11 for grinding member is mounted on the central member 5 following said procedure, and then, the rotary grinding jig in accordance with the present invention has been mounted and fixed to the rotating shaft 71 of the grinder 70 (fig.14).

[0156] Alternatively, the central member 5 and the retaining member 11 for grinding member are combined with each other in advance, and then, this rotary grinding jig can be fixed to the rotating shaft 71 of the grinder 70 using the fixing screw 73.

[0157] Fig.15 is a perspective view explanatory of the disassembly of all the components of the rotary grinding jig as shown by figs.12 to 14.

[0158] The grinding member 2 is composed of a plurality of grinding sheets 21. Each of the grinding sheets 21 is a small piece having substantially a rectangular or trapezoidal shape. The grinding sheet so called here includes cloth coated with abrasive powders as well as paper, such as sand paper, coated with abrasive powders.

[0159] The respective grinding sheets 21 are arranged on top of one another with the adjacent grinding sheets 21 leaning against each other, i.e. inclining relative to the surface of the retaining member 11 for grinding member so as to be glued by adhesive to the first retaining member 11a of the retaining member 11 for grinding member. In addition to the sand paper, whetstones, unwoven cloths, rubbers, diamonds, etc., can be used as grinding member.

[0160] The retaining member 11 for grinding member comprises the first retaining member 11a in the central side thereof and the second retaining member 11b positioned in the outside thereof, the outer periphery of the former being joined to the inner periphery of the latter. The joint or combination between the both members only takes the form of an engagement so that they are removable from each other.

[0161] As above-mentioned, the first retaining member 11a has circular hollow portion 11c formed in the middle thereof and including a cylindrical portion 11i extending in the surface side (the upper side in the drawing) and two ridges 11d serving as rotative engagement portion formed on its inner periphery and having a length substantially equal to a quarter of its circumferential length. A notch 11k is formed substantially in the middle of each of the ridge 11d. The number of the ridge 11d and notch 11k as indicated was simply given by way of example, so it is properly changeable.

[0162] The second retaining member 11b positioned in the outside of the retaining member 11 for grinding member consists of a ring-shaped disk having in the middle thereof a through-hole 11e which may receive said first retaining member 11a.

[0163] When the first and second retaining members 11a, 11b are combined with each other into a retaining member 11 for grinding member, the surface IIs of the first retaining member 11a and the surface 11t of the second retaining member 11b are positioned flush with each other so as to support the grinding member 2 from behind.

[0164] There is provided a step portion 11h running all through the inner periphery of the through-hole 11e of the second retaining member 11b, and another step portion 11h which is adaptable to said step portion 11h is also provided on the outer peripheral edge of the first retaining member 11a.

[0165] The above-described configuration permits the central member 5 to removably engage with said retaining member 11 for grinding member at all times with the central member 5 and the rotating shaft of the rotary drive in fixed relationship; if the grinding member 2 has uselessly worn out, the retaining member 11 for grinding member is removed from the central member 5, followed by further removal of the second retaining member 11b of the retaining member 11 for grinding member, thereby enabling continuation of another grinding operation.

[0166] Thereafter, in case the grinding member 2 further increased its attrition to become useless, this grinding member 2 and the first retaining member lla are thrown away so as to be exchanged for new ones.

[0167] Figs.16 and 17 illustrate another embodiment of the retaining member for grinding member in accordance with the present invention, fig.16 being a perspective view showing from behind the disassembly of the first retaining member and the second retaining member, and fig.17 a rear elevation showing the assembly of the both members. In these drawings, the ones illustrated in figs.12 to 15 are shown inside out. The grinding member is shown positioned in the underside, accordingly.

[0168] A retaining member 12 for grinding member as illustrated in said drawings is different from that of the embodiment as shown in fig.15 only in the engagement portion for the first and second retaining members 12a, 12b except for the other structures.

[0169] The first retaining member 12a has ridges 12d formed on the inner peripheral edge of the hollow portion

12c for engaging with the central member, and the ridges 12d include notches 12k in the middle thereof respectively.

[0170] There are provided grooves 12n as receiver cut in and spaced on the outer peripheral edge of the first retaining member 12a. The grooves 12n each extend further peripherally of the first retaining member 12a, so that they look like the letter L viewing from the side.

[0171] The second retaining member 12b consists of a ring-shaped disk having a through-hole 12e in the center thereof, its outer diameter being slightly smaller than that of the grinding member 2, and the through-hole 12e having ridges 12m as engagement portion spaced in four sections of the inner periphery thereof. These ridges 12m are adapted to be engaged in the grooves 12n as provided on the outer peripheral edge of the first retaining member 12a. Both the ridge 12m and groove 12n function as engagement means.

[0172] In fig.16, the second retaining member 12b is moved downwards as to bring the ridges 12m provided on the inner periphery of the through-hole 12e and the openings of the grooves 12n cut in the outer peripheral edge of the first retaining member 12a into positional coincidence with each other to force the second retaining member 12b into the outside of the first retaining member 12a. Then, by turning the second retaining member 12b in the direction of arrow R, the ridges 12m and the grooves 12n can be combined with each other.

[0173] Contrary to the described structure in the ridges 12m and the groves 12n, the ridges 12m may be provided on the outer peripheral edge of the first retaining member 12a and the grooves 12n may be provided on the inner peripheral edge of the second retaining member 12b.

[0174] The retaining member 12 for grinding member into which the first and second retaining members 12a, 12b has been mutually combined with each other is in a position to be engaged with the central member 5. Since the central member 5 has been made slightly larger than the first retaining member 12a in outer diameter, there is no fear of the second retaining member 12b dropping out of the first retaining member 12a.

[0175] In this embodiment, however, as there is no separation of the second retaining member 12b from the first retaining member 12a by any chance on the ground that the first and second retaining members 12a, 12b stand in the engaged association with each other by the aid of the ridges 12m and the grooves 12n, namely as due to the engagement between the ridges and the grooves, there is no chance whatsoever of the second retaining member 12b leaving the first retaining member 12a under the influence of a force running from the surface side in which the retaining member for grinding member is positioned to the rear side though the second retaining member 12b is exposed to attack of said force, there is no need of the second retaining member 12b being backed up, and so, the outer diameter of the central member 5 can be made smaller than that of the first retaining member 12a. This means that the second retaining member 12b may not be held by the grinding member 2 and the central member 5 in a position between the two members.

[0176] The grinding member glued to the first retaining member 12a is not shown in figs.16 and 17.

[0177] With this embodiment, a plurality of circular holes 12r are arranged in line. These holes 12r are intended for clamping the first retaining member 12b against the first retaining member 12a when in the mounting operation for the members and radiating heat while the rotary grinding jig is at work as well. This radiation of heat is very effective. Heat produced in the grinding member during the grinding operation can be discharged through said holes, which, thus, can achieve the air cooling function thereby avoiding any scorching of the grinding member and workpieces to be ground.

[0178] This specific hole may also be used in all the other embodiments as disclosed here.

[0179] This effect of heat dissipation is also attributed to the generation of air flows between the outer peripheries of grinding sheets because in this embodiment, the grinding member is composed of a plurality of grinding sheets and these grinding sheets are only adhesively attached to the first retaining member 12a positioned in the center.

[0180] In this embodiment, the number of the ridges 12m and the grooves 12n may be adequately changed as needed.

[0181] The second retaining member 12b positioned in the outside can be dismounted from the first retaining member 12a even if the first retaining member 12a is kept in contact with the central member 5.

[0182] Furthermore, the grooves having the shape of a letter L viewing from the side and extending in the peripheral direction may be formed so as to further extend in a reverse direction at the corner of the grooves 12n.

[0183] Fig.18 illustrates another embodiment of the retaining member for grinding member in accordance with the present invention with a perspective view of the disassembly of the first retaining member and the second retaining member viewing from the side. This drawing does not show the grinding member adhesively attached to a first retaining member 13a either, but the grinding member is actually designed to be joined to the lower side of the first retaining member 13a.

[0184] The structure of the hollow portion 13c of the first retaining member 13a is the same as that of the embodiment as shown in fig.16. Therefore, no explanation will be made.

[0185] The first retaining member 13a includes two extensions 13v each having a length compared to substantially a quarter of the circumference thereof and formed in two positions symmetrically about a point. A second retaining member 13b is adapted to engage at its ridges 13u (engaging portion) with the undersides of these extensions 13v (engaged portion) . More than two

extension 13v may be used as needed.

[0186] The ridges 13u and the undersides of the extensions provide a engagement means.

[0187] On the other hand, the second retaining member 13b consists of a ring-like disk, having ridges 13u each having a length compared to substantially a quarter of the circumference thereof and formed symmetrically on the surface side of the inner periphery of a central through-hole 13e in two points. More than two ridges 13u may also be used as needed.

[0188] Engagement of the ridges 13u with the underside of the extensions 13v (engaged portion) may be achieved by fitting the second retaining member 13b into the first retaining member 13a from the rear side and turning the former in the direction of arrow R.

[0189] A design may be provided such that the ridge 13u can be abutted by one end against a terminal portion provided on a proper position of the underside of the extension 13v into engagement with the latter. If the terminal portion is provided on the intermediate site of each extension 13v, the engagement operation will be completed by the ridge 13u which has abutted against the terminal portion, and the ridge 13u will abut against another terminal portion even when it turns in an opposite direction in which disengagement takes place. Thus, said terminal portion may provide a dropout-preventive means.

[0190] In order to establish more assured engagement between the ridges 13u and the extensions 6v, one or more projections are provided on the upper face of the ridge 13u and one or more depressions are provided on the lower face of the extension 6v in such a manner that both the ridge and extension may be engaged with each other. There may be used an arrangement to the contrary, the projection may be defined on the lower face of the extension 6v and the depression on the upper face of the ridge 6u. Naturally, this specific arrangement of these projection and depression may be applied to the engagement means in the other embodiments.

[0191] This embodiment can also be practiced by the central member 5 whose outer diameter is smaller than the maximum outer diameter of the first retaining member 13a as in the embodiment shown by fig.16. This is because it is not necessary for the second retaining member 13b to be supported by the grinding member and central member in a position between them. It is natural, however, that the outer diameter of the central member may be made larger than the maximum diameter of the first retaining member 13a in a manner such that the central member can back up the second retaining member 13b from behind.

[0192] If the outer diameter of the central member 5 is made smaller than the maximum diameter of the first retaining member 13a and also smaller than the inner diameter of the second retaining member 6b, the second retaining member 13b can be separated from the first retaining member 13a with the first retaining member 13a and the central member 5 kept in engagement relationship, thus resulting in easier removal of the second retaining member 13b when the grinding member is worn out.

[0193] Fig.19 illustrates another embodiment of the retaining member for grinding member in accordance with the present invention with a perspective view of the disassembly of the first and second retaining members viewing from the side.

[0194] The grinding member adhesively attached to a first retaining member 14a is not shown in this drawing either. This grinding member is adapted to be joined to the underside of the first retaining member 14a.

[0195] The structure of the inner periphery of the hollow portion 14c of the first retaining member 14a is the same as that of said previous embodiment.

[0196] On the outer periphery, depressions 14q are formed in two symmetrical positions. Ridges 14p defined on the inner periphery of through-hole 14e of a second retaining member 14b may be appropriately received by said depressions 14q.

[0197] As in the previous embodiment, the second retaining member 14b consists of a ring-like disk having the through-hole 14e formed in the middle thereof. The ridges 14p are disposed on the rear side of the inner periphery of the through-hole 14e in two symmetrical positions so that the ridges 14p may be fitted in the depressions 14q defined on the outer periphery of said first retaining member 14a respectively.

[0198] There may also be available an arrangement to the contrary; the ridges 14p are provided on the first retaining member 14a and the depressions 14q on the second retaining member 14b.

[0199] Engagement of the first retaining member 14a and the second retaining member 14b can be achieved by bringing the depressions 14q of the first retaining member 14a and the ridges 14p of the second retaining member 14b into positional agreement with each other and allowing the second retaining member 14b to come from the rear side of the first retaining member 14a to the outside of the first retaining member 14a so as to place the second retaining member 14b on the first retaining member 14a for engagement purpose. And then, although not specified in the drawing, the central member having an outer diameter larger than the inner diameter of the second retaining member 14b is engaged by its rear side (from above in the drawing) with the second retaining member 14b to ensure that the second retaining member 14b will be secured to the first retaining member 14a.

[0200] When the grinding member mounted on the grinder wears out during the grinding operation to such a degree that its outer periphery has reduced almost equal to the outer diameter of the second retaining member 14b, the retaining member 14 for grinding member is removed from the central member 5, then the second retaining member 14b in the outside is removed from the retaining member 14 for grinding member, then the first retaining member 14a formed integral

with the worn-out grinding member is mounted on the central member 5 again for further grinding operation. The subsequent grinding operation can last until the attrition of the grinding member develops close to the outer periphery of the first retaining member 14a.

[0201] The structure of engagement in this embodiment is excellent in that as the engagement of the first and second retaining members 14a, 14b of the retaining member 14 for grinding member is based on the engagement of the depressions 14q and the ridges 14p, the both members can be fully prevented from turning relative to each other when the grinding operation is in action or has come to a stop.

[0202] Fig.20 illustrates a further embodiment of the rotary grinding jig in accordance with the present invention with a perspective view of separated components of said jig observing from the side.

[0203] In this embodiment, unlike in the aforementioned embodiments, the base of the rotary grinding jig is not of a three-piece type but a two-piece one. In this drawing, the grinding member is designed to be adhesively joined to the base in the underside, too.

[0204] The base substantially in the shape of a disk consists of two components such as a central portion 8 and an outer peripheral portion 9 positioned on the outside of said central member. The central member 8 has a rotating shaft mounting hole 8e formed in the center thereof to fixedly receive the rotating shaft of a grinder, and four grooves 8n as engaged portion spaced on the outer peripheral edge.

[0205] More specifically, each of the grooves 8n is formed substantially in the shape of a letter L such that it extends from the rear side down to a point at the surface side where it further spreads in a peripheral direction.

[0206] The outer peripheral portion 9 positioned on the peripheral side of the base is of a ring-like disk type, having four projections 9m serving as engaging portion formed on the inner periphery thereof.

[0207] The outer peripheral portion 9 and the central portion 8 may be combined with each other by engaging these projections 9m with the grooves 8n formed on the outer peripheral edge of the central portion 8.

[0208] More specifically, the projections 9m of the outer peripheral portion 9 and the openings of the grooves 8n in the central portion 8 are brought into positional agreement with each other, and then, the central through-hole 9e of the outer peripheral portion 9 is allowed to come from the rear side of the central portion 8 to the outer peripheral face of the central portion 8 for coincidence purpose until the outer peripheral portion 9 is fitted into the central portion 8, and if the outer peripheral portion 9 is turned in the direction of arrow R, the both portions may be joined with each other.

[0209] By the aid of the engagement through this engagement means, the outer peripheral portion 9 can cope with a force travelling in an axial direction of the rotating shaft, i.e., from the surface side (grinding member 2's side) to the rear side.

[0210] Of course, the grinding member 2 is only joined by adhesive to the surface side of the central portion 8 but not to the surface of the outer peripheral portion 9. Therefore, the outer peripheral portion 9 can be removed from the central portion 8.

[0211] The grinding member 2 may be of any type as in said embodiments. In this invention, therefore, the base composed of two members can be available for practice as a two-piece type as in this embodiment.

[0212] In this embodiment, the bases of various kinds can be employed as engagement means like the one of a three-piece type as mentioned above. So, the engagement means as shown in fig.18 is also applicable. This particular engagement means may be of any structural type as long as it permits the peripheral portion 9 combined with the central portion 8 to match for a force running from the surface side to the rear side.

[0213] The peripheral length of the projection 9m and the number of same may be properly set as needed.

[0214] Fig.21 is a sectional view explanatory of the state in which the rotary grinding jig of the fifth embodiment as shown in figs.12 to 14 has worn down, (A) showing the wearing limit of said jig with second retaining member attached thereto, and (B) the wearing limit of same with no second retaining member.

[0215] Referring to fig.21(A), the retaining member 11 for grinding member is a combination of a first retaining member 11a in the center and a second retaining member 11b on the outside thereof. In operation, the grinding member 2 gradually wears thinner in the central portion and its outer peripheral edge portion also gets extinct from the frontal part. When the diameter of the peripheral edge portion approaches the outer peripheral edge portion of the second retaining portion 11b on the outside of the retaining member 11 for grinding member, the grinding operation may become difficult to perform. This is because the peripheral edge portion of the second retaining member 11b is reduced to an obstacle to grinding.

[0216] In this state, since the first and second retaining members 11a, llb is kept in contact with each other, grinding can be carried out with the grinding member 2 being strongly pressed on a workpiece to be ground.

[0217] At the time when the grinding member 2 wore away by friction, the retaining member 11 for grinding member is removed from the central member 5, the second retaining member 11b on the outside is withdrawn, and the first retaining member 11a on which the worn-out grinding member 2 rests is engaged with the central member 5 again (fig.21(B)) for further continuation of the grinding operation.

[0218] As this operation goes on, the attrition of the grinding member 2 increases so as to render the central portion thinner, and then, the outer peripheral edge portion reduces in size nearly to the outer diameter of the outer peripheral edge portion of the first retaining member 11a, when the grinding operation can no longer con-

tinue. The grinding member 2 has become unusable by now, and is thrown away.

[0219] After the second retaining member 11b has been discarded, there exists no retaining member 11 for grinding member on the outside, so the grinding member 2 can be brought into a soft touch with a workpiece to be ground, whereby the optimum grinding intended for curved areas on workpieces being ground can be put into practice.

[0220] As observable from figs.21(A) and (B) (the section of the grinding member 2 as indicated with a dotted line in fig.21(B) identifies the grinding member 2 as shown by fig.21(A)), if a retaining member for grinding member used is not of a two-piece type, the grinding member as shown in fig.21(A) has clearly done its term of service, but the structure of the retaining member for grinding member of a two-piece type makes it possible to use the grinding member 2 until it wears out to a degree as shown in fig.21(B), so this can greatly cut abolition of grinding members.

[0221] As described above, in said embodiments in accordance with the present invention, the rotary grinding jig comprising a central member 5, a retaining member 11 for grinding member, and a grinding member 2, the central member 5 and the retaining member 11 for grinding member being removably joined to each other, is characterized in that the retaining member 11 for grinding member is composed of two members such as a first retaining member 11a positioned in the center and a second retaining member 11b on the outside thereof (namely, the base is of a three-piece type, comprising central member 5, first retaining member 11a and second retaining member IIb), and that the second retaining member IIb on the outside can be removed dependent on the degree of attrition of the grinding member 2.

[0222] Alternatively, the base is characterized in that it is made up of two components (i.e. of a two-piece type) such as a central member 8 and an outer peripheral portion 9 so that the outer peripheral portion 9 and central member 8 can be removably joined to each other, and that the outer peripheral portion 9 can be removed dependent on the degree of attrition of the grinding member 7.

[0223] The structure of engagement means for the first and second retaining members 11a, 11b of the retaining member 11 for grinding member may be completely designed.

[0224] The outer peripheral face of the first retaining member IIa is simply constituted by a true vertical plane, and the inner peripheral face of the through-hole 11e of the second retaining member 11b is also constituted by a vertical plane without providing any engagement means in such a manner that the both members can be just fitted with each other. In the alternative, it is natural that such a joining area may provide an inclined plane. In this case, the maintenance of engagement and fixing of both members can be made possible by pressing the disk body 5a of the central member 5 from the surface side. That is, the second retaining member 11b may be maintained by the central member 5 on the rear side thereof and cope with a force running from the surface side to the rear side.

[0225] Various type of mechanical engagement means such as the engagement of projections and depressions, the engagement of corresponding step portions, the rotative engagement of projections and grooves, etc., can be employed as engagement means for the first and second retaining members 11a, 11b of the retaining member 11 for grinding member. One of these engagement means may be provided in either of the first and second retaining members 11a, 11b, and the other one in the other retaining member.

[0226] The design for material, shape, thickness, size, etc., of each of the components may be freely changed.

[0227] For the grinding member, sheet-like products of different kinds of materials such as paper, cloth, or unwoven cloth with various sorts of abrasive particles covering the length and breadth thereof, or with abrasive particles incorporated in the surface and inside thereof, or a disk-like product having abrasive particles combined thereinto and a predetermined thickness, and product of a type in which abrasive particles will emerge therefrom sequentially as a wearing away by friction advances is particularly preferable.

[0228] With the base composed of two-piece, the central member and the outer peripheral portion, both these engagement means can similarly be changed into different designs as in a three-piece base.

[0229] In any of the embodiments, as already set forth, the second retaining member positioned on the outside of the retaining member for grinding member or the outer peripheral portion of the base may be provided with an additional cooling function having a plural holes for emitting heat generated during the grinding operation.

[0230] Referring to the rotary grinding jig in accordance with the first invention of the present application, since the base is composed of the retaining member for grinding member and the central member formed independent from each other, if the grinding member has worn out into uselessness, only the grinding member and the retaining member for grinding member may be removed and thrown away, and then, exchanged for new ones, while the central member can be continuously used rather than is discarded. This may contribute to the environmental protection, the saving resource, and a cut in production cost.

[0231] The retaining member for grinding member and the central member can be removably fixed to each other by the rotative engagement means in a simple manner.

[0232] The existence of the retaining member for grinding member enable the use of every type of grinding members of hard or soft quality.

[0233] When the retaining member for grinding mem-

ber and the central member are engaged with each other, the both of them are loaded by the rotation of the rotating shaft of a rotary drive in a direction in which the engaging strength of the rotative engagement portions of the both members are increased, thereby avoiding any disengagement of both members during the grinding operation.

[0234] As the outer diameter of fixing means for fixing the central member to the rotating shaft is smaller than the inner diameter of the hollow portion of the retaining member for grinding member, the retaining member for grinding member and the grinding member can be removed with the central member kept in a firm contact with the rotating shaft.

[0235] With the rotary grinding jig in accordance with the second invention of the present application, now that the grinding member and the retaining member for grinding member are molded so as to be combined into a unit of hard quality, a separate retaining member for grinding member is not specifically needed.

[0236] In accordance with the rotary grinding jig of the third invention of the present application, the base is composed of three members, i.e. a central member, a first retaining member, and a second retaining member, only the central member and second retaining member can repetitively be used, and only the worn-out grinding member and first retaining member are destined to be thrown away, but the grinding member can be so exhaustively used out that when a grinding member has worn out uselessly enough to be abolished, the quantity of wastes can be reduced to a minimum. This may contribute to the saving resource and the environmental protection, and a cut in production cost as well, accordingly.

[0237] Additionally, as the outer peripheral portion of the base (the second retaining member) is removably mounted, when the outer peripheral portion rests in its position, a workpiece being ground can be machined with the grinding member strongly pressed on the former, while in the absence of the peripheral portion, the grinding member may be so softly pressed on the workpiece that curved sections of the workpiece can be processed in an optimum manner.

[0238] In the rotary grinding jig in accordance with the fourth invention of the present application, because the central member can support and maintain the second retaining member on its rear side, the second retaining member can be combined with the first retaining member even if there exists no special engagement means between the first and second retaining members.

[0239] In the rotary grinding jib in accordance with the fifth invention of the present application, the engagement means for the first and second retaining members may avoid the necessity of supporting or maintaining by the central member of the second retaining member from the rear side.

[0240] In the rotary grinding jig in accordance with the sixth invention of the present application, if the rotating shaft of the rotary drive stops, the grinding member turns in a direction in which the engagement of the retaining member for grinding member and the central member is dissolved, but such a turning can be checked by stopper means.

[0241] In the rotary grinding jig in accordance with the seventh invention of the present application, if the rotary drive of a grinder suddenly stops, the retaining member for grinding member turns in a direction in which the engagement with the central member is dissolved, and then, will behave in a direction (the direction of the rotating shaft of the rotary drive) in which it separates from the central member, but its dropout-preventive means can help check eventual separation and dropout of the retaining member for grinding member from the central member toward the rotating shaft of the rotary drive.

[0242] In the rotary grinding jig in accordance with the eighth invention of the present application, as the outer peripheral portion of the base is removably attached to the central member, if the grinding member mounted on the surface of the outer periphery becomes worn to uselessness, the outer peripheral portion may be removed from the central member for further grinding operation.

Claims

1. A rotary grinding jig including a disk-like base having a grinding member (2) such as abrasive cloth or grindstone provided on the surface thereof, and a connecting portion (5e) formed in the center thereof so as to be connected with the rotating shaft of a rotary drive, characterized in that the base comprises a retaining member (11) for grinding member provided with the grinding member (2) andacentral-member (5) having said connecting portion (5e), that said retaining member (11) for grinding member includes a hollow portion (11c) consisting of a through-hole in the center thereof and having a rotative engagement portion (11d) defined on the inner edge portion thereof or close thereto, that

a rotative engagement portion (5d) engaged with said rotative engagement portion (11d) is provided on the central member (5), that the rotative engagement portion (11d) of the retaining member (11) for grinding member is adapted to engage with the rotative engagement portion (5d) of the central member (5) by turning in a direction opposite to the direction in which the rotating shaft of the rotary drive rotates, and such a resulted engagement is dissolved by turning the rotative engagement portion (11d) in a reverse direction, whereby the rotation of the rotating shaft of the rotary drive may cause further increase of mutual locking between both rotary engagement portions (11d) (5d), that the connecting portion (5e) of the central member (5) consists of a rotating shaft mounting hole, the rotating shaft of the rotary drive is inserted into said con-

necting portion (5e) so that the central member (5) may be fixed to the rotating shaft of the rotary drive by a fixing means such as nut or bolt, that the outer diameter of said fixing means is made smaller than the inner diameter of thehollowportion (11c) of said retaining member (11) for grinding member, whereby the retaining member (11) for grinding member may be separated with the central member (5) remaining fixed to the rotating shaft.

2. The rotary grinding jig as defined in claim 1 characterized in that the grinding member (2) and the retaining member (11) for grinding member are hard structures made of grindstones and resin and formed integral with each other.

3. The rotary grinding jig as defined in claim 1 characterized in that the retaining member (11) for grinding member is constituted by a first retaining member (11a) positioned in the center side and a second retaining member (11b) positioned in the outside thereof, that said second retaining member (11b) is removably attached to said first retaining member (11a), that the first retaining member (11a) is removably engaged with the central member (5), and that grinding operation may be continuously resumed by removing the second retaining member (11b) from the first retaining member (lla) according to the attrition of the grinding member (2).

4. The rotary grinding jig as defined in claim 3 characterized in that the second retaining member (11b) is retained by the central member (5) on the rear side thereof with the first retaining member (11a) combined thereto.

5. The rotary grinding jig as defined in claim 3 or 4 characterized in that engaging portions such as projections (12m) are provided on one of the outer peripheral edge portion of the first retaining member (12a) and the inner peripheral edge portion of the second retaining member (12b), and engaged portions such as grooves (12n) on the other one, so that the both members may be removably engaged with each other by engagement means such as said engaging portions and said engaged portions, and said engagement means allow the second retaining member (12b) to cope with an axial force running from the surface side to the rear side.

6. The rotary grinding jig as defined in any preceding claim, characterized in that a stopper member (35) that can play vertically is placed in a proper position of the central member (5) for preventing the retaining member (11) for grinding member from turning in a direction in which the engagement of the retaining member (11) for grinding member and the central member (5) is dissolved.

7. The rotary grinding jig as defined in any preceding claim, characterized in that when the retaining member (11) for grinding member turns in a direction in which the engagement of the retaining member (11) for grinding member and the central member (5) is dissolved, a dropout-preventive means is placed in a proper position of the retaining member (11) for grinding member or the central member (5) for preventing the retaining member (11) for grinding member from falling from the central member (5) in the direction of the rotating shaft of the rotary drive.

8. A rotary grinding jig comprising a disk-like base fixed to the rotary shaft of the rotary drive of a grinder and a grinding member (2) provided on the surface side of said base, characterized in that the base is composed of a central member (8) positioned in the center thereof and an outer peripheral portion (9) positioned on the periphery thereof, that the outer peripheral portion (9) of the base is removably connected with the central member (8), and that grinding operation may be continuously resumed by removing the outer peripheral portion (9) from the central member (8) according to the attrition of the grinding member (2).

F I G . 1

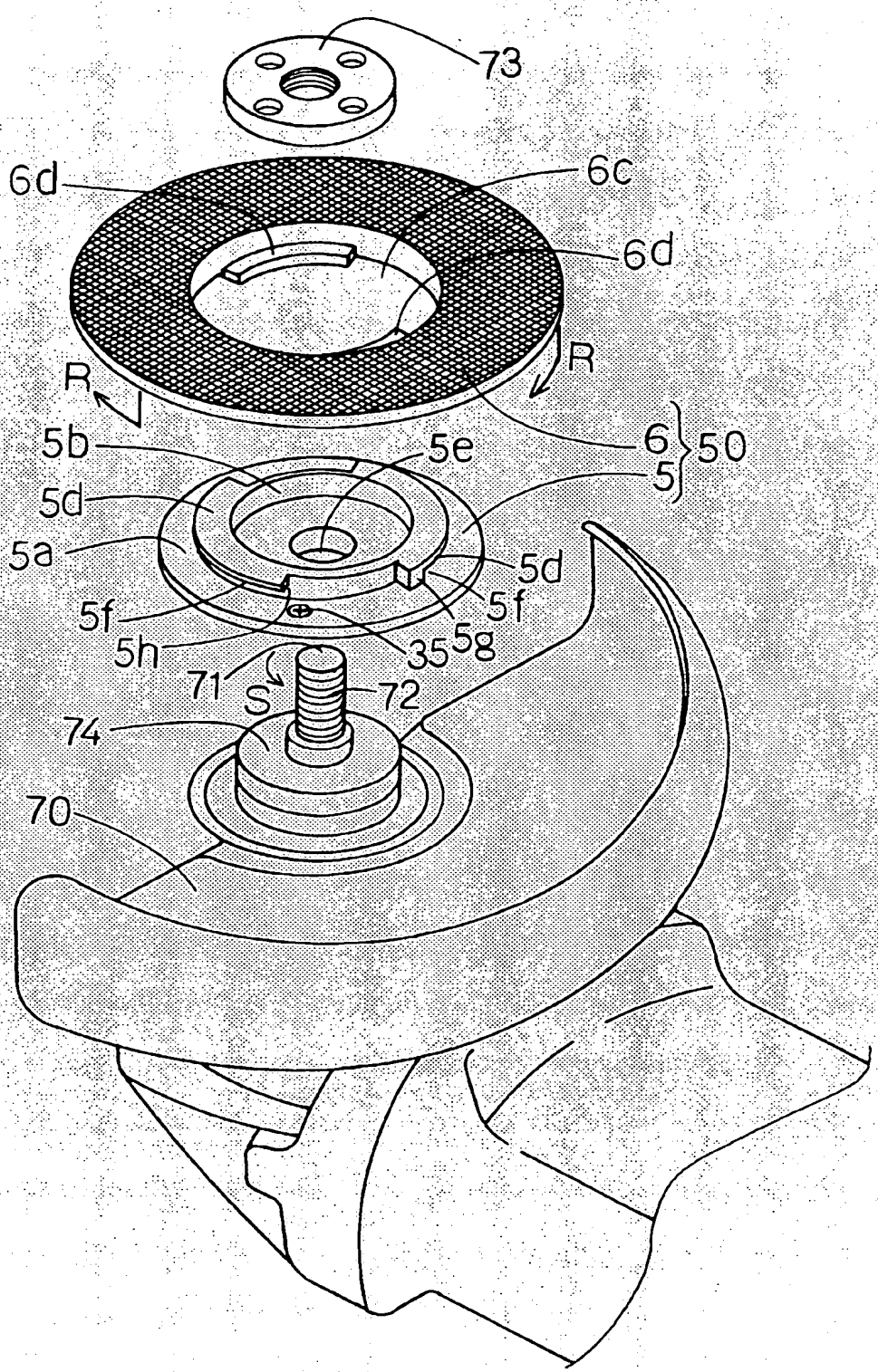


FIG. 2

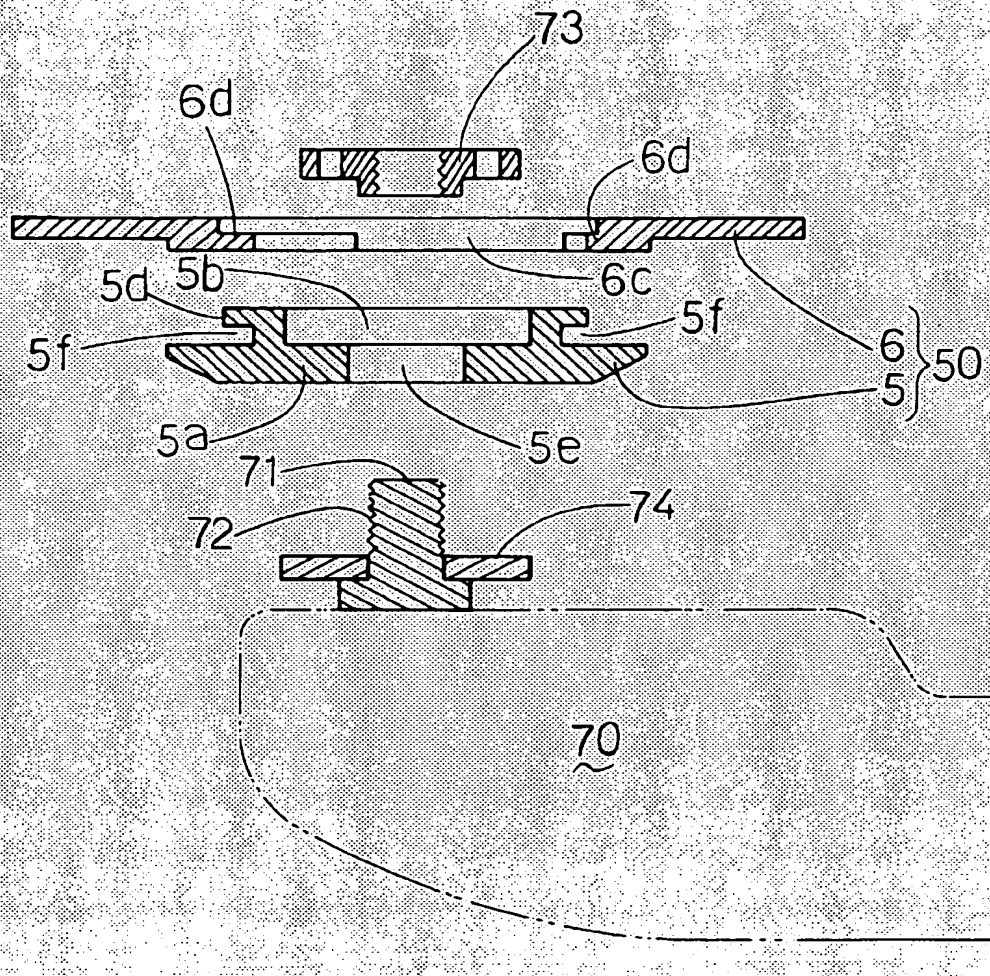


FIG.3

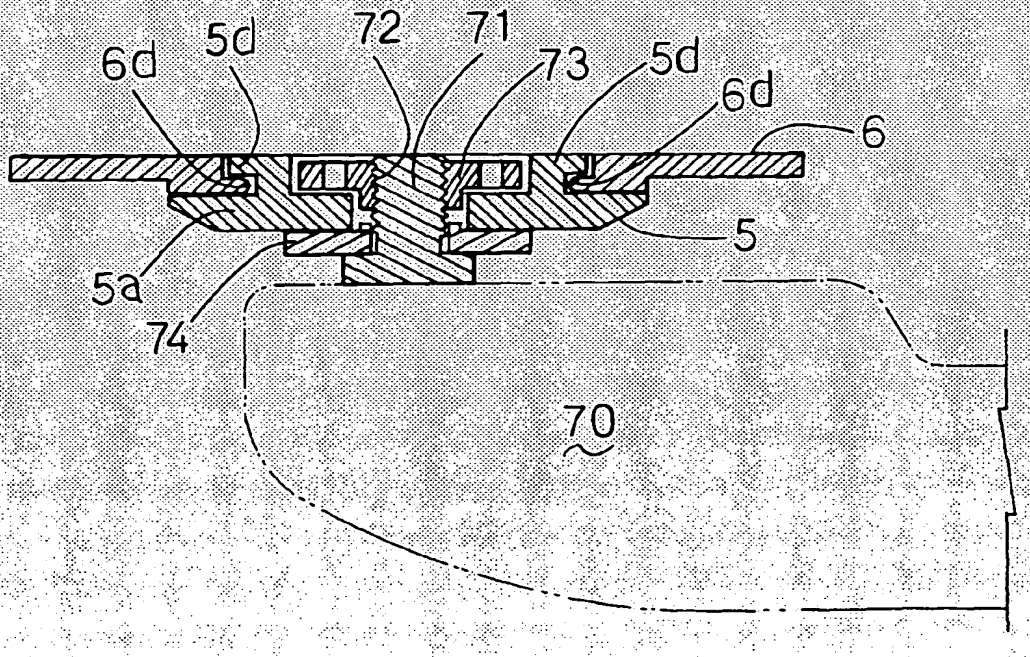


FIG. 4

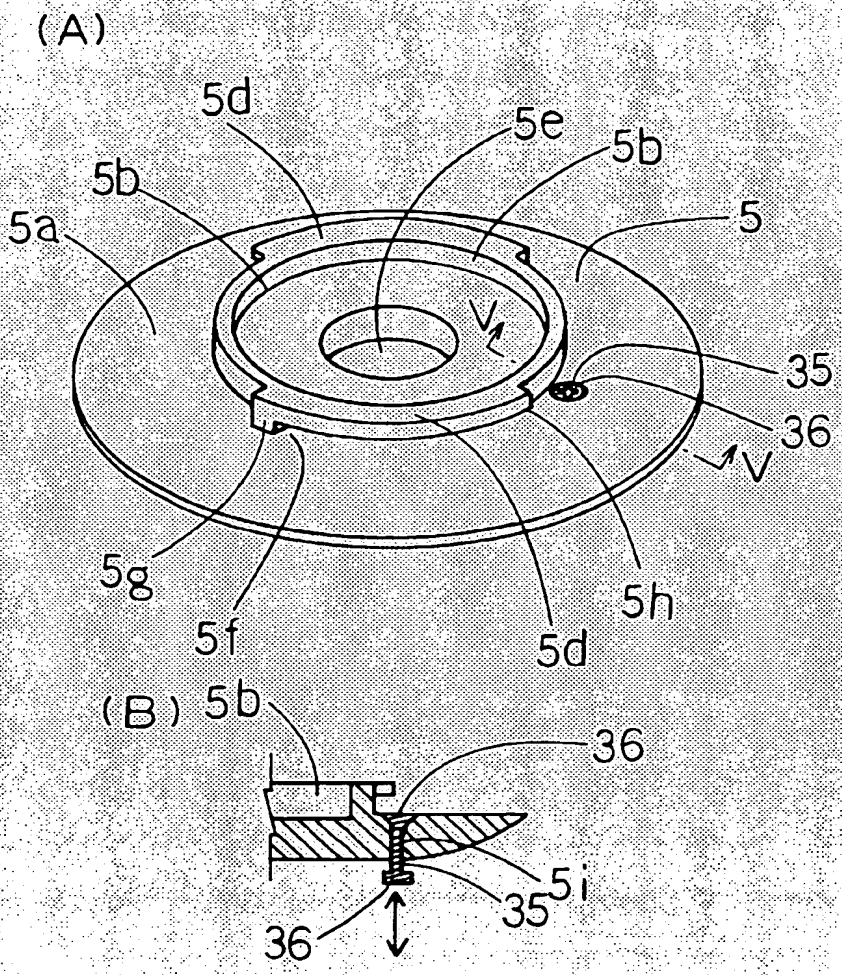


FIG. 5

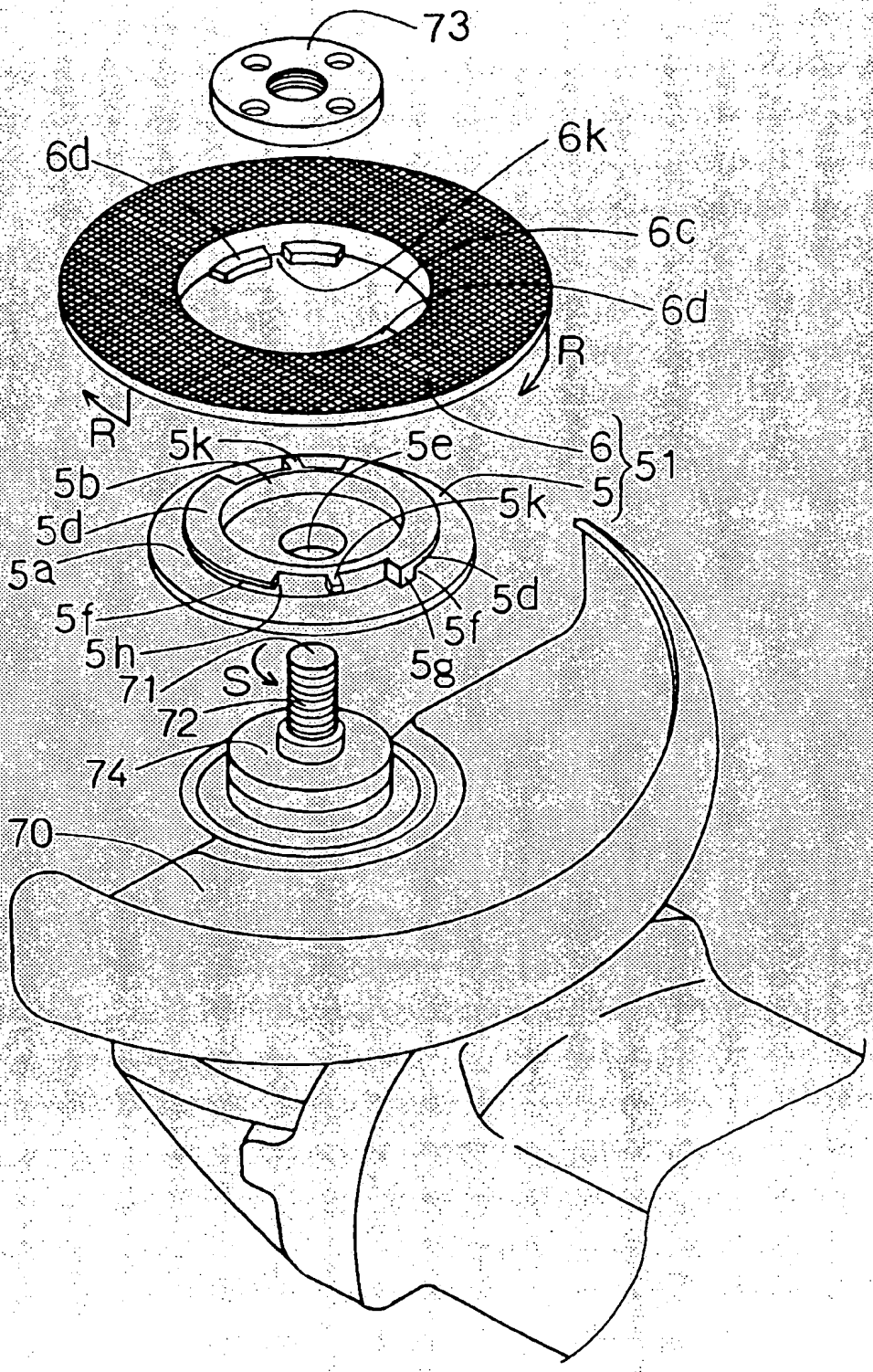


FIG. 6

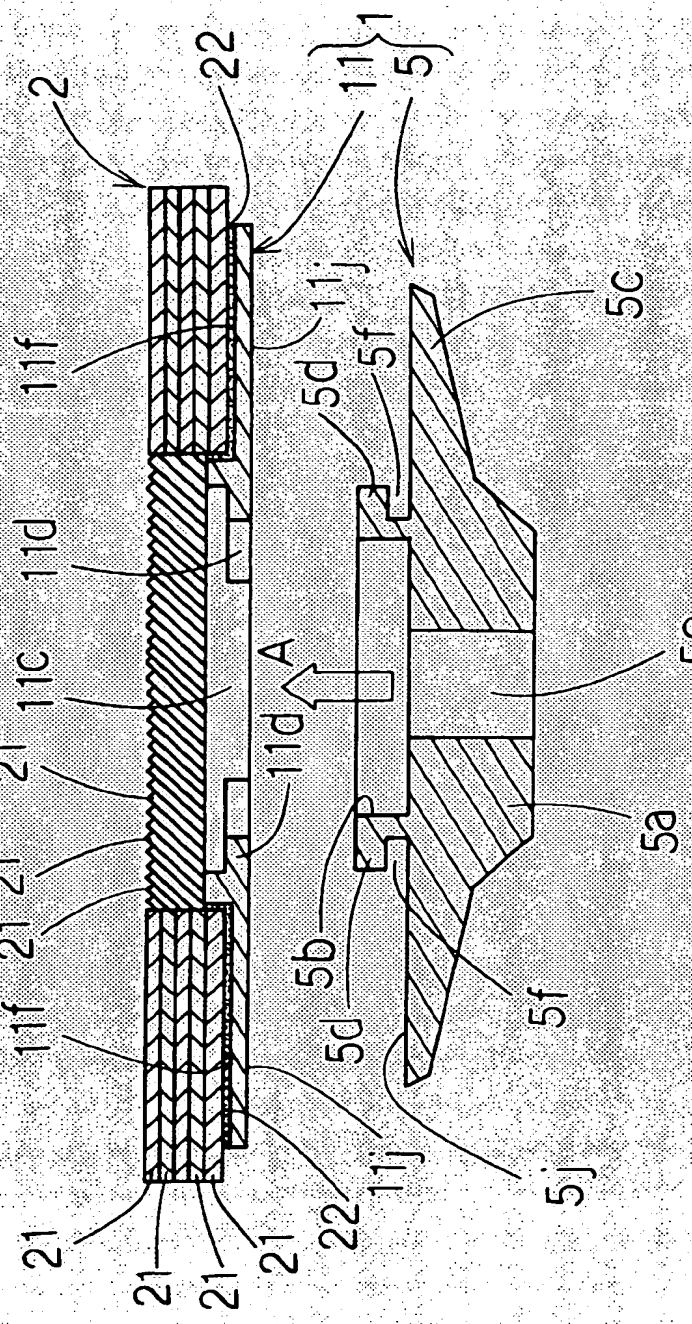

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11f
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FIG. 7

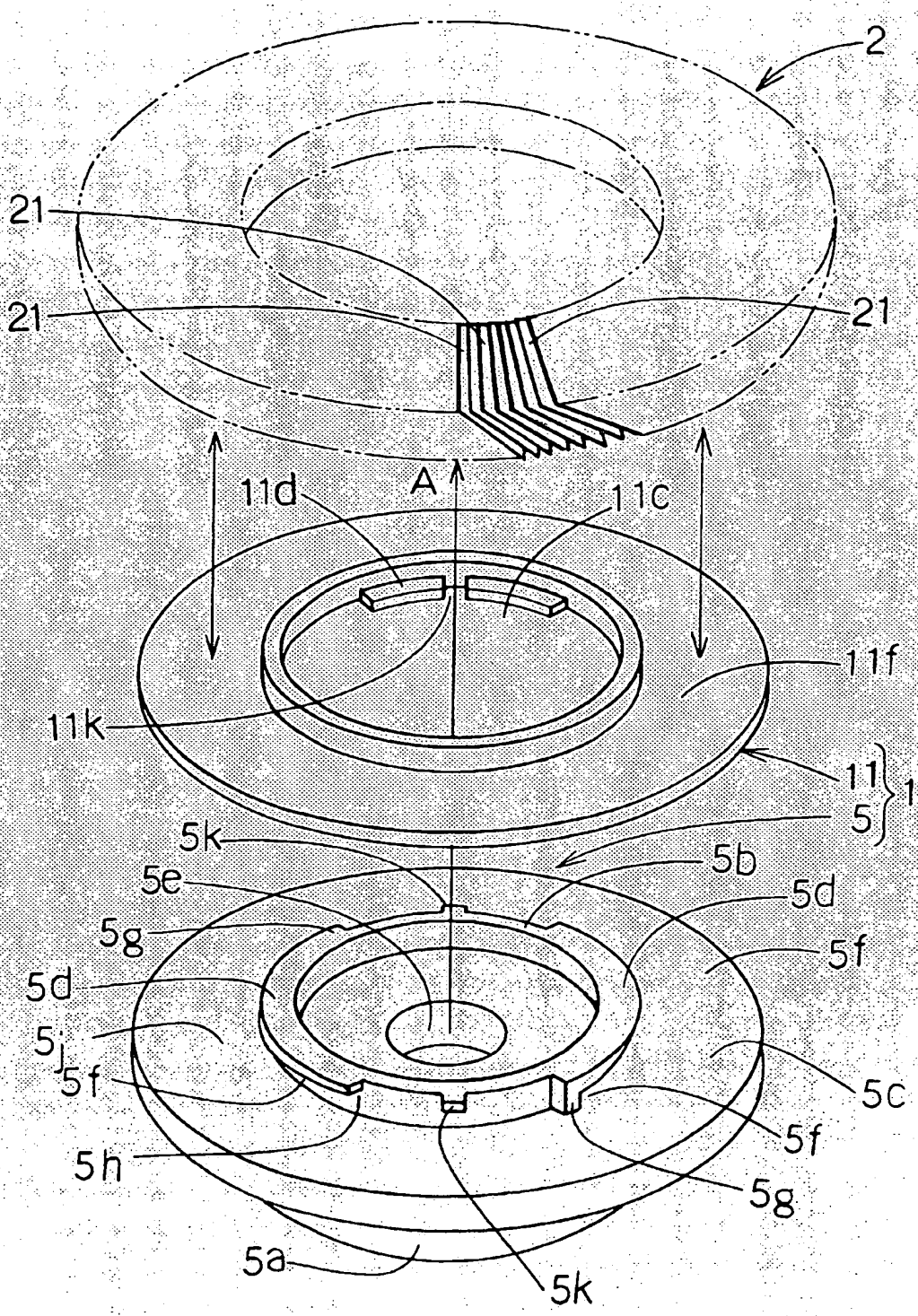

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FIG.8

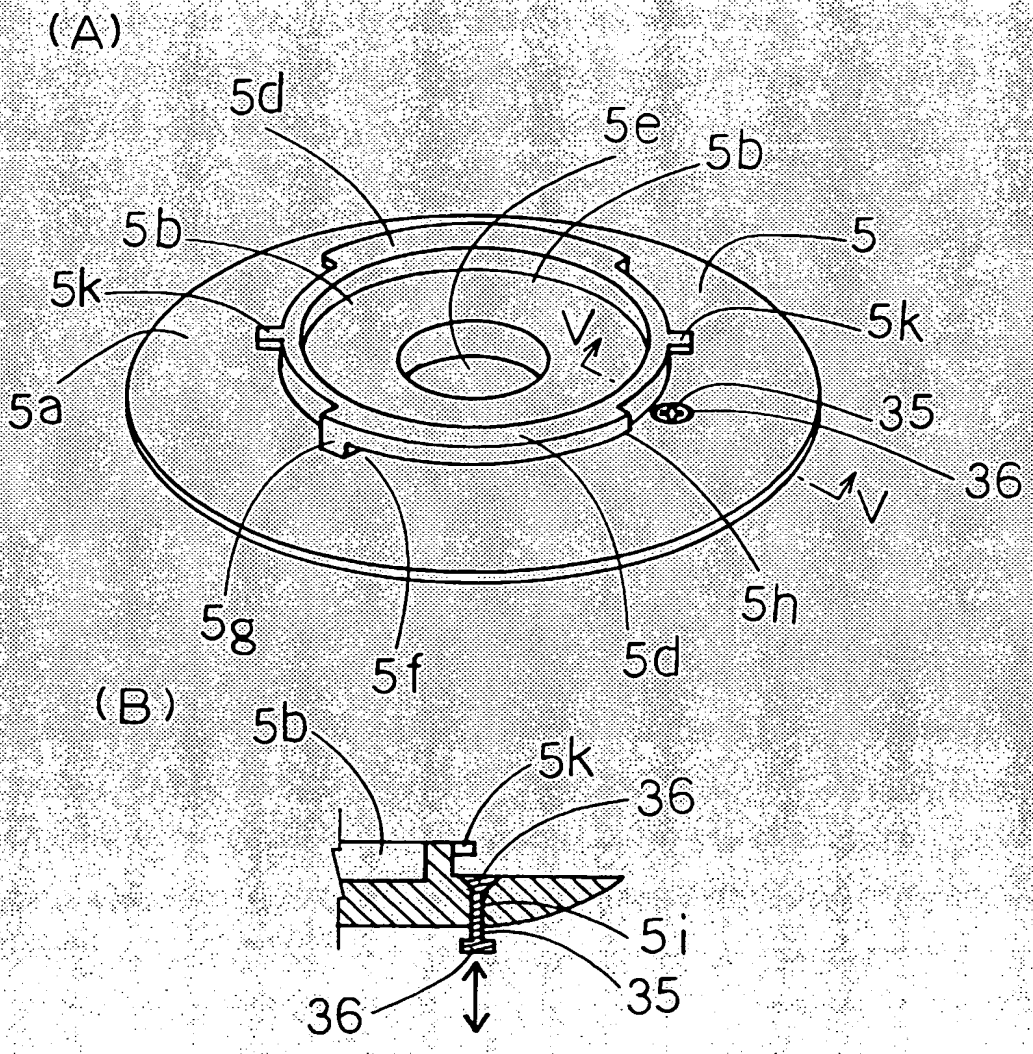


FIG.9

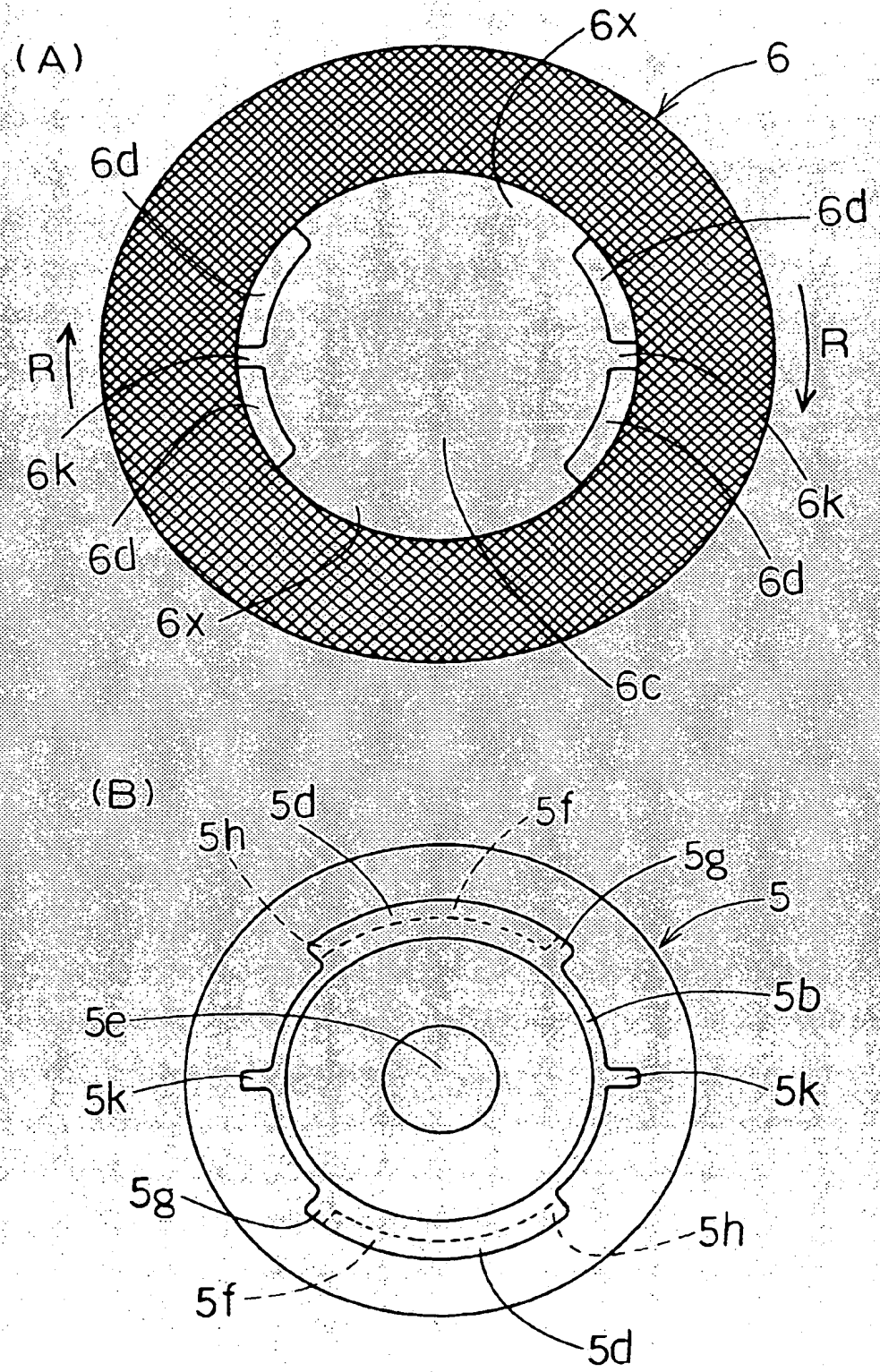


FIG.10

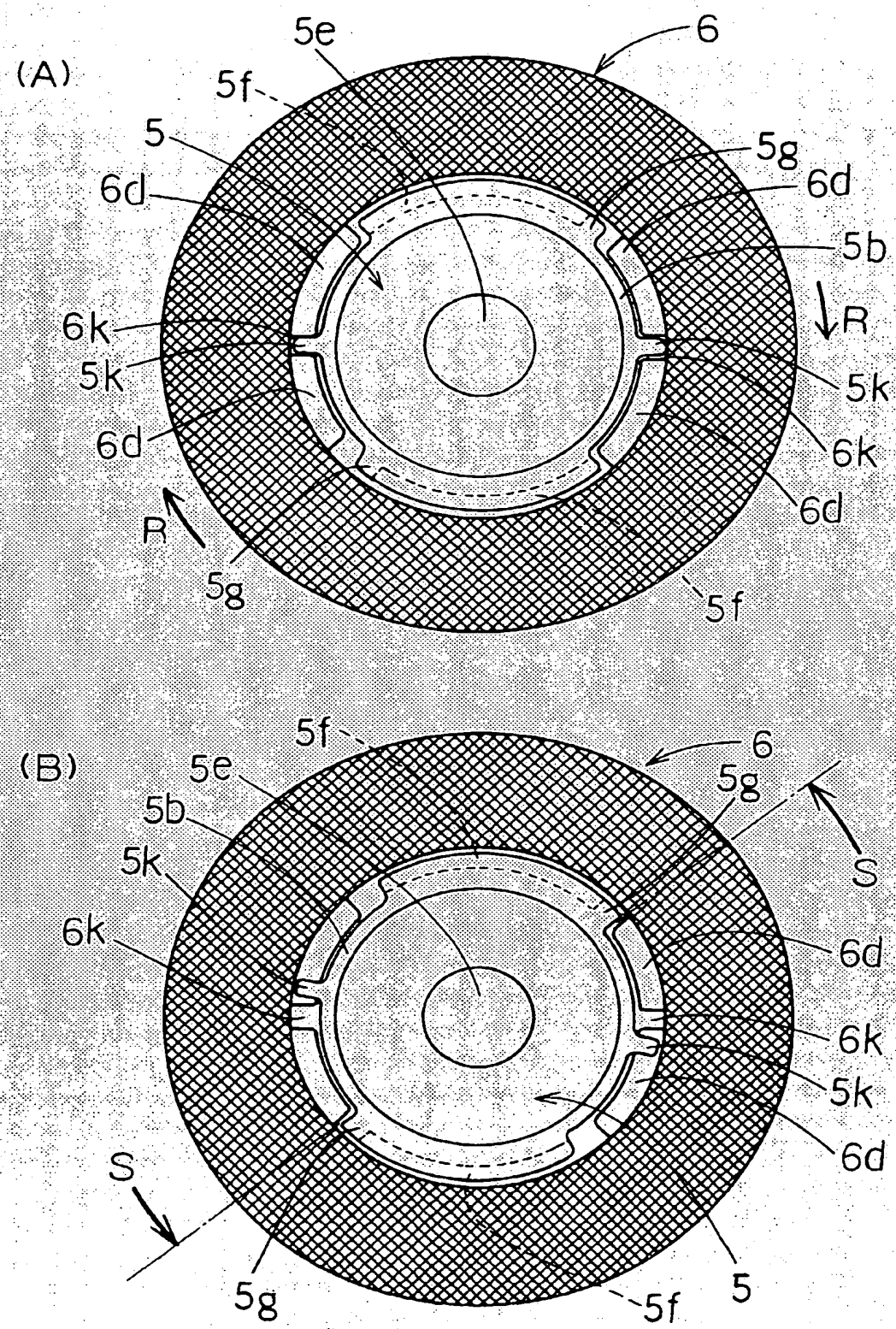

(A)
5e
6
5f
5
5g
6d
6d
5b
R
6k
5k
5k
6d
6k
6d
R
5g
5f
(B)
5f
6
5e
5g
5b
5k
S
6k
6d
6k
5k
6d
S
5g
5f
5

FIG. 11

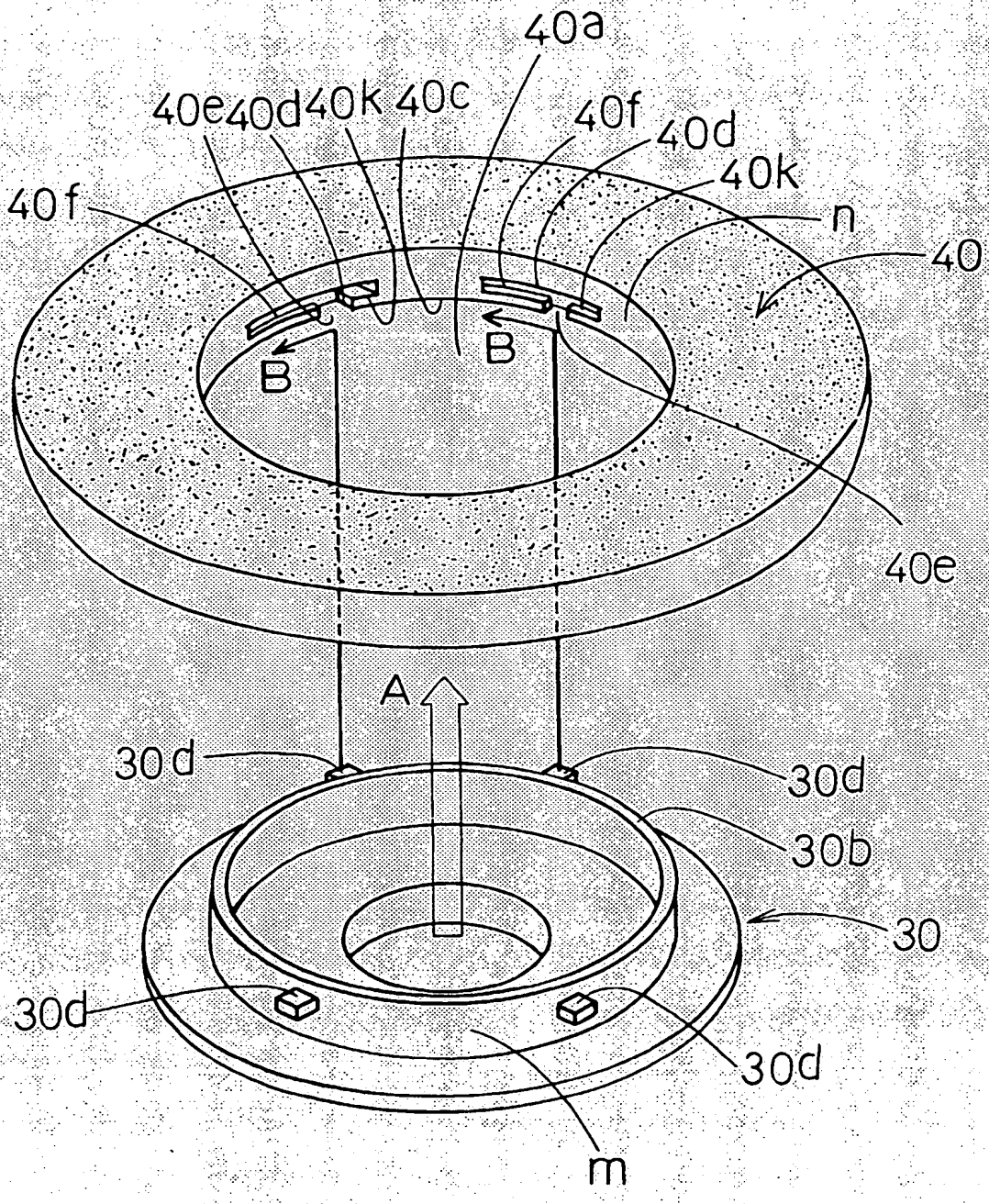

40a
40e
40d
40k
40c
40f
40d
40k
n
40
40f
B
B
40e
A
30d
30d
30b
30
30d
30d
m

FIG. 12

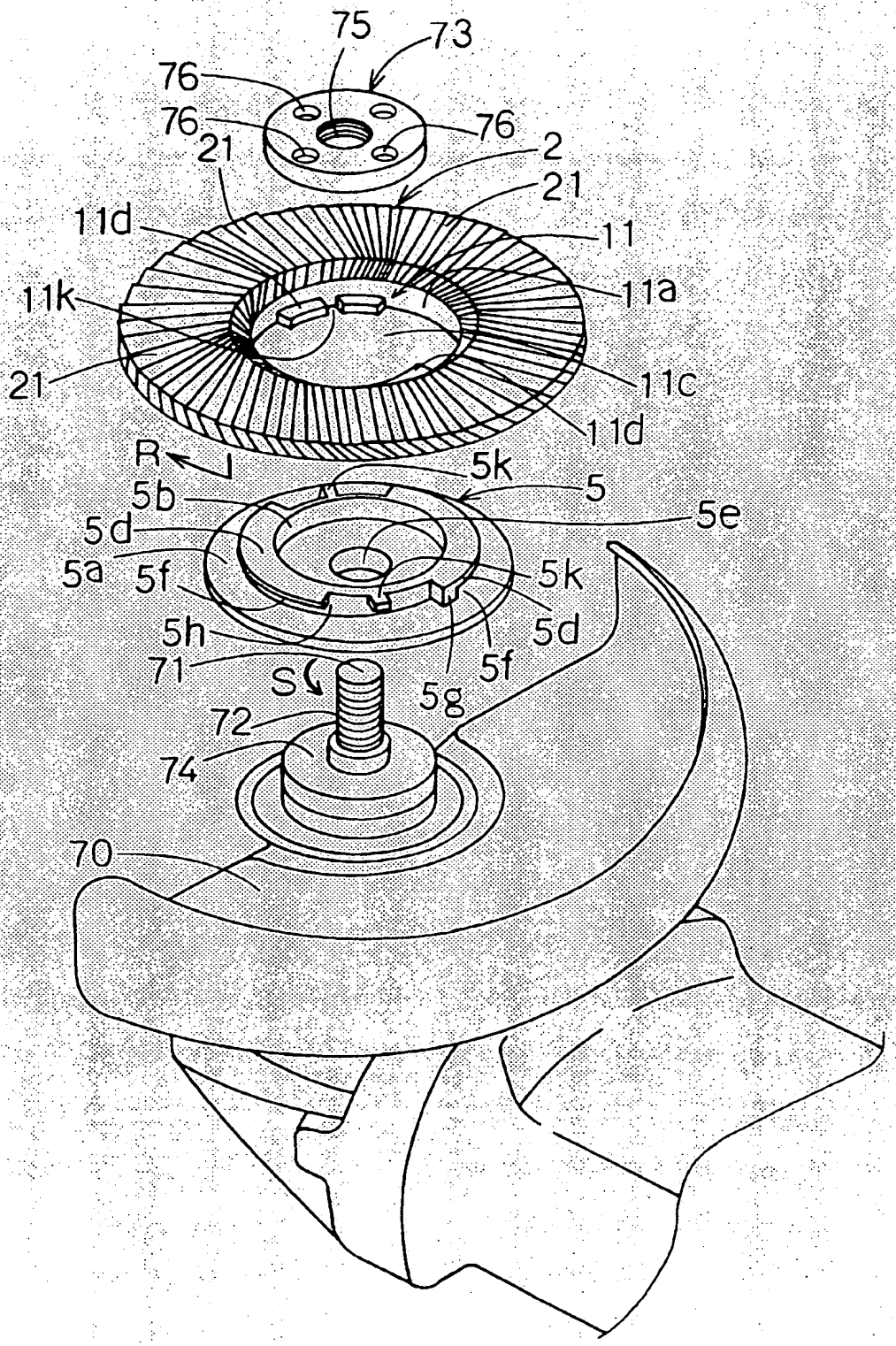

75
73
76
76
76
21
2
21
11d
11
11k
11a
21
11c
11d
R
5k
5b
5
5d
5e
5a
5f
5k
5h
5d
71
S
5f
5g
72
74
70

FIG. 13

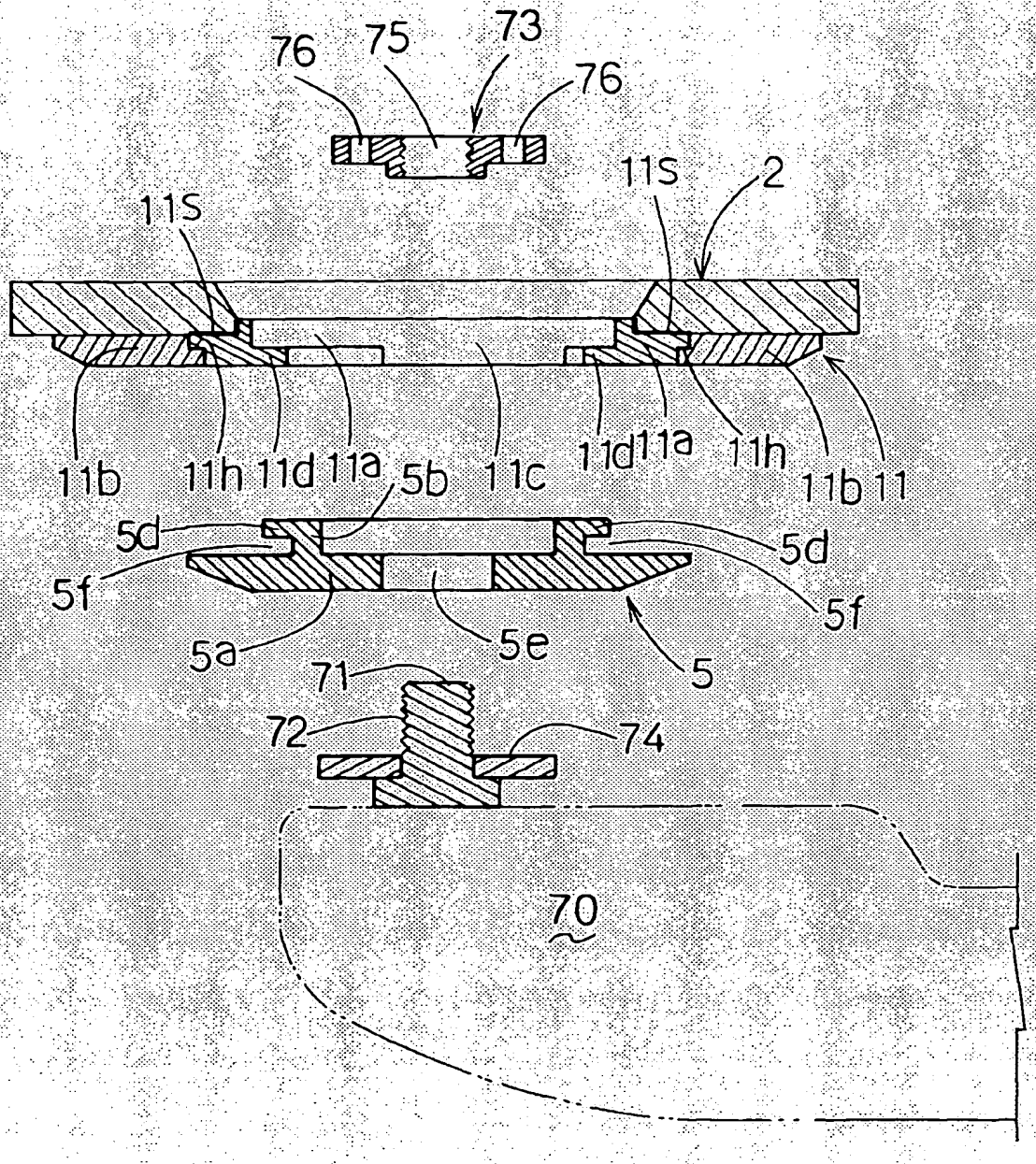

76
75
73
76
11S
2
11S
11b
11h
11d
11a
5b
11c
11d
11a
11h
11b
11
5d
5d
5f
5f
5a
5e
5
71
72
74
70

FIG. 14

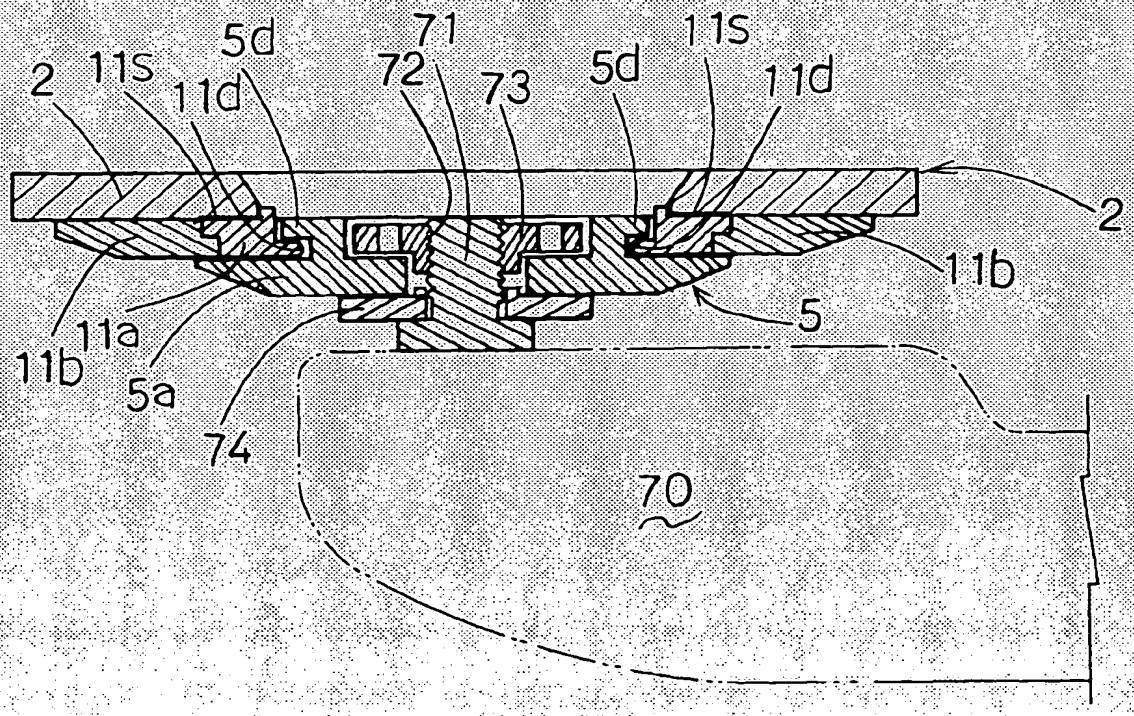


FIG.15

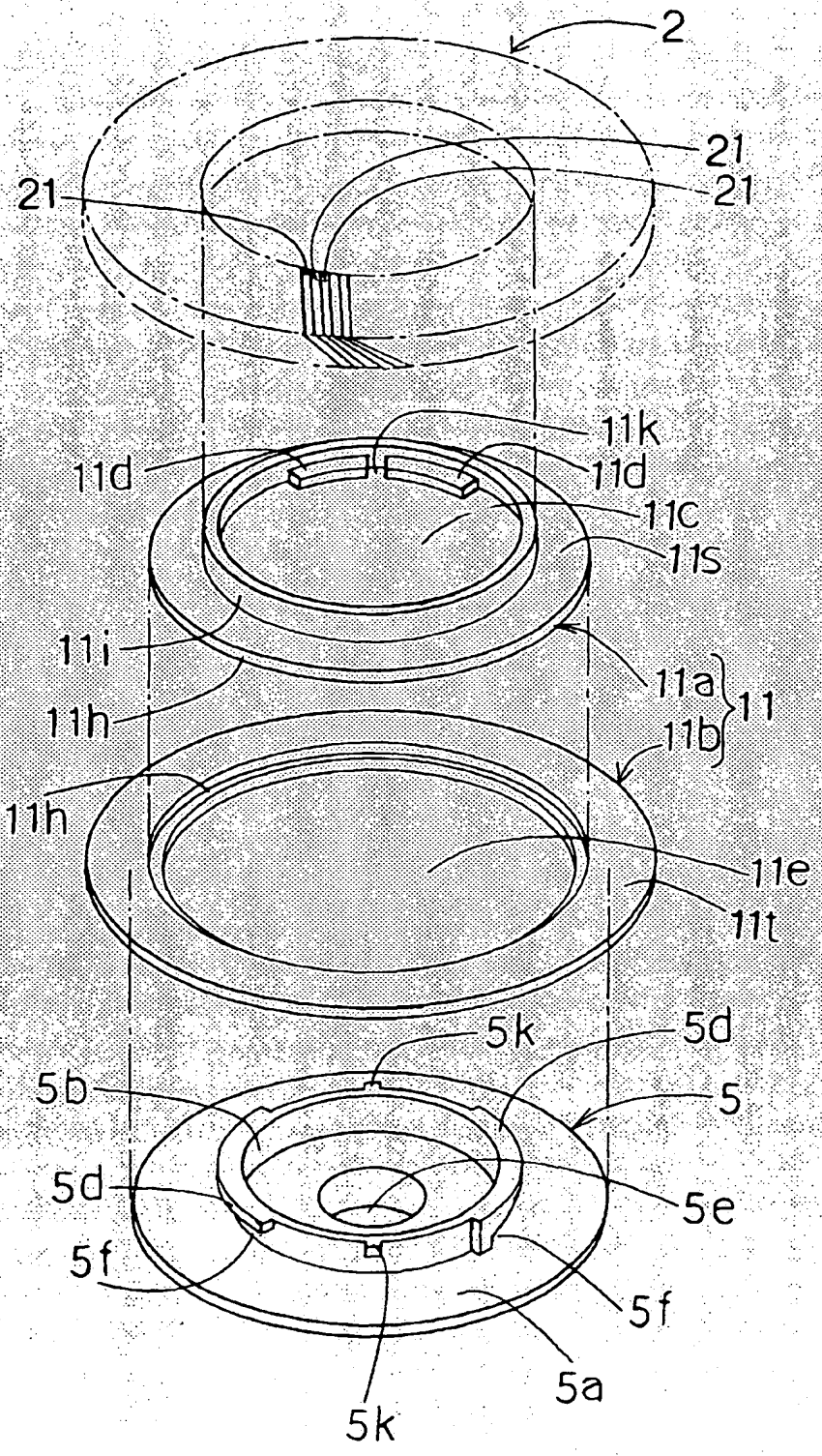

2
21
21
21
11k
11d
11d
11c
11s
11i
11h
11a
11b
11
11h
11e
11t
5k
5d
5b
5
5d
5e
5f
5f
5a
5k

FIG. 16

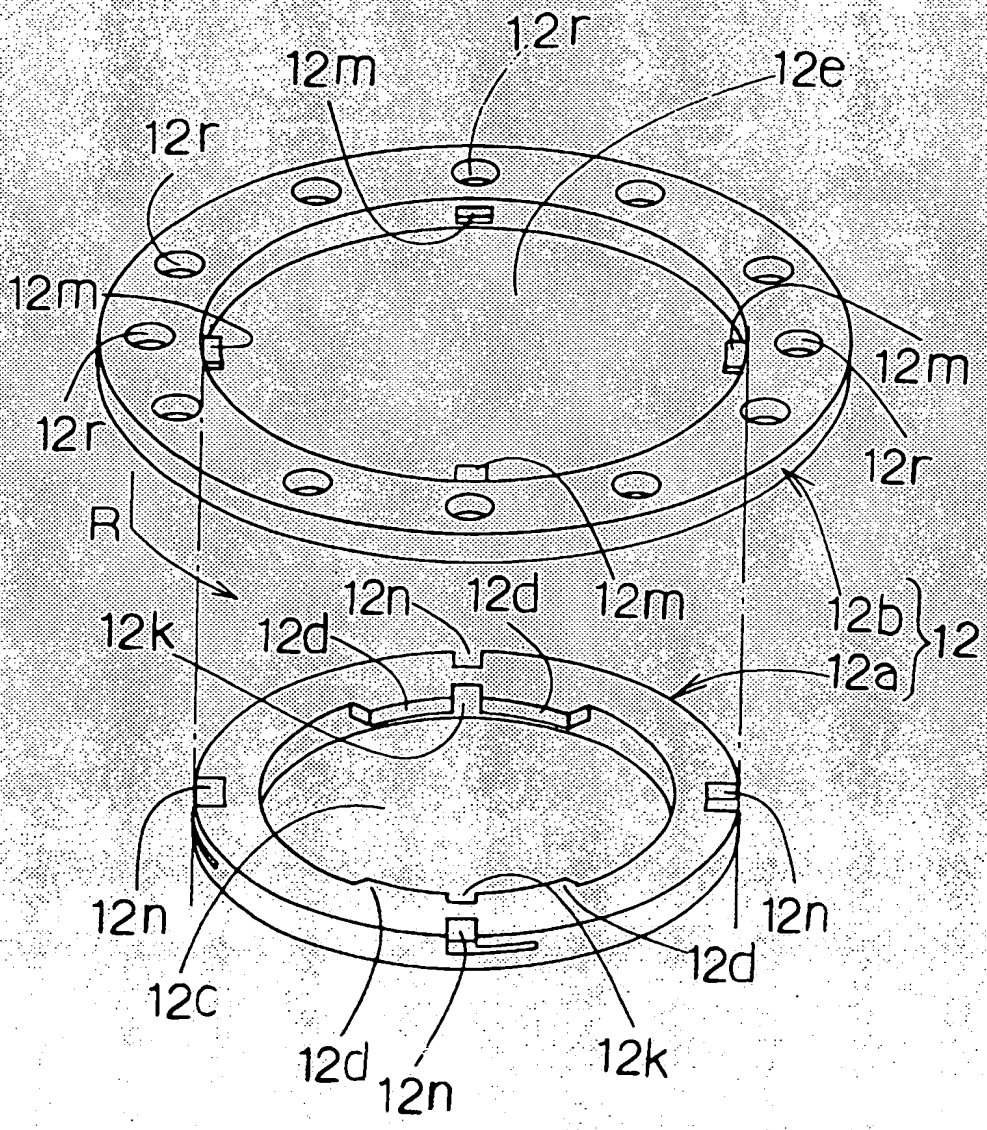

12r
12m
12e
12r
12m
12r
12m
12r
R
12k
12d
12n
12d
12m
12b
12a
12
12n
12c
12d
12n
12k
12d
12n

FIG.17

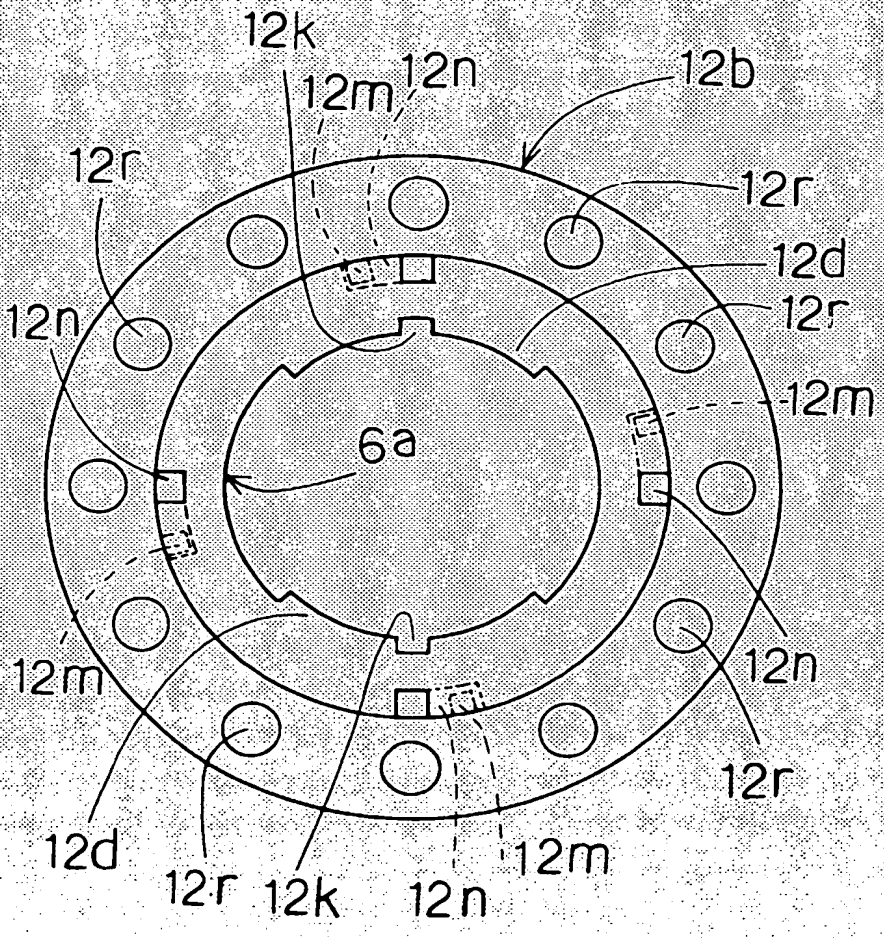

12k
12m
12n
12b
12r
12r
12d
12r
12n
12m
6a
12m
12n
12r
12d
12r
12k
12n
12m

FIG.18

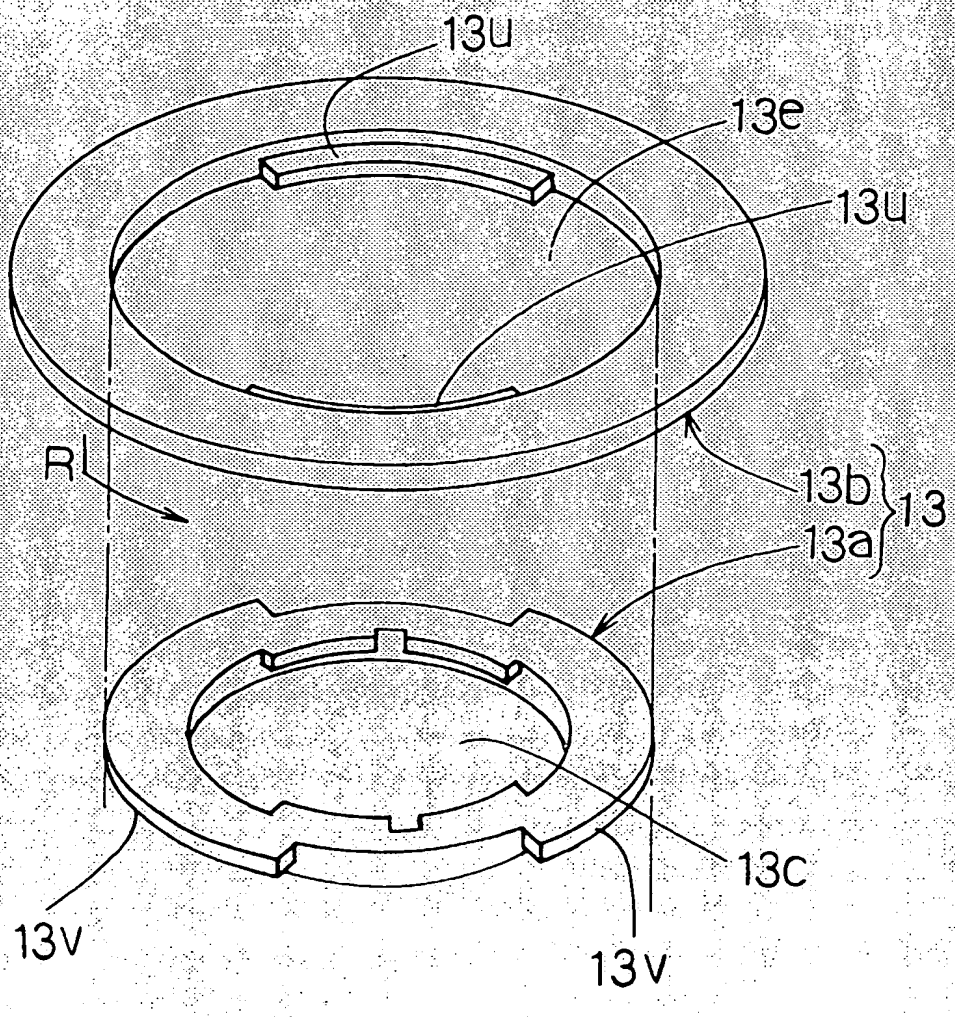


FIG.19

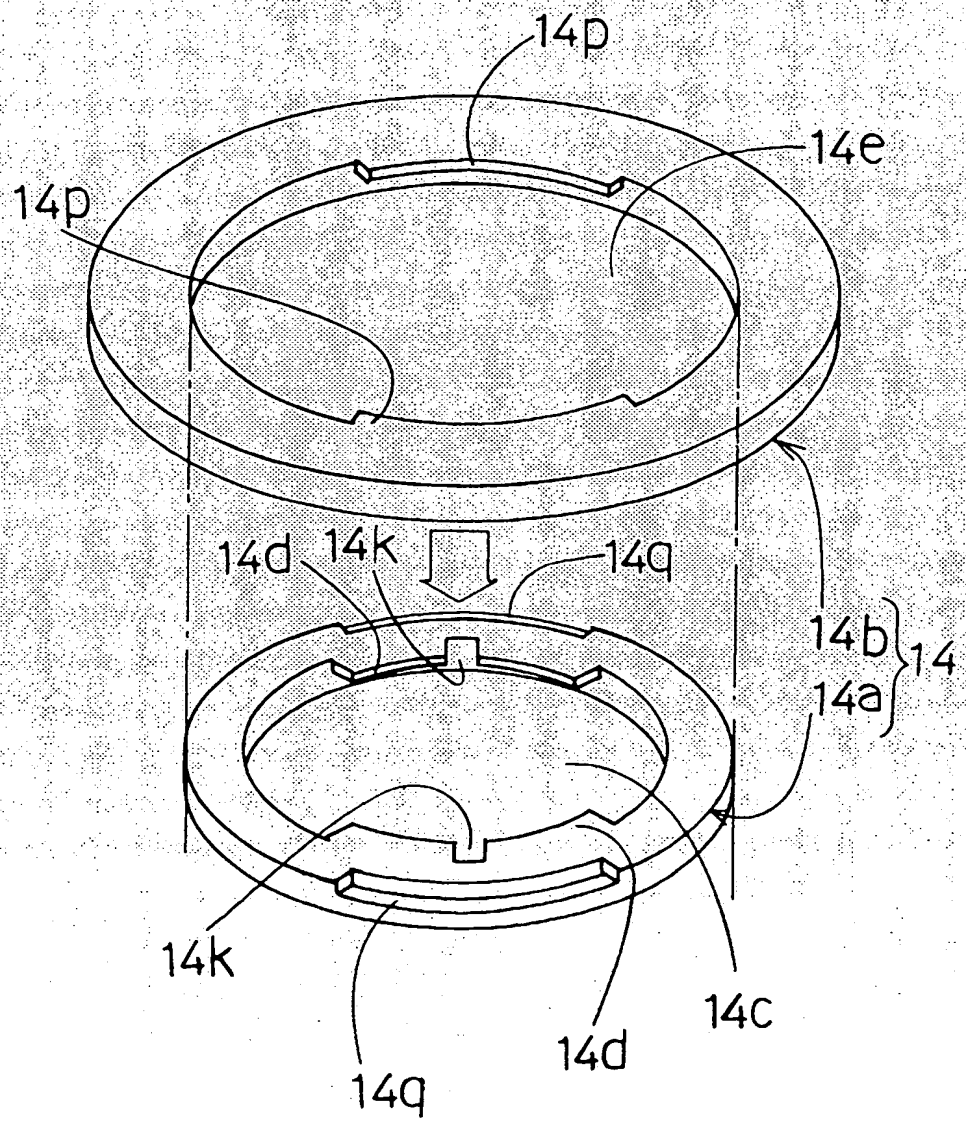


FIG.20

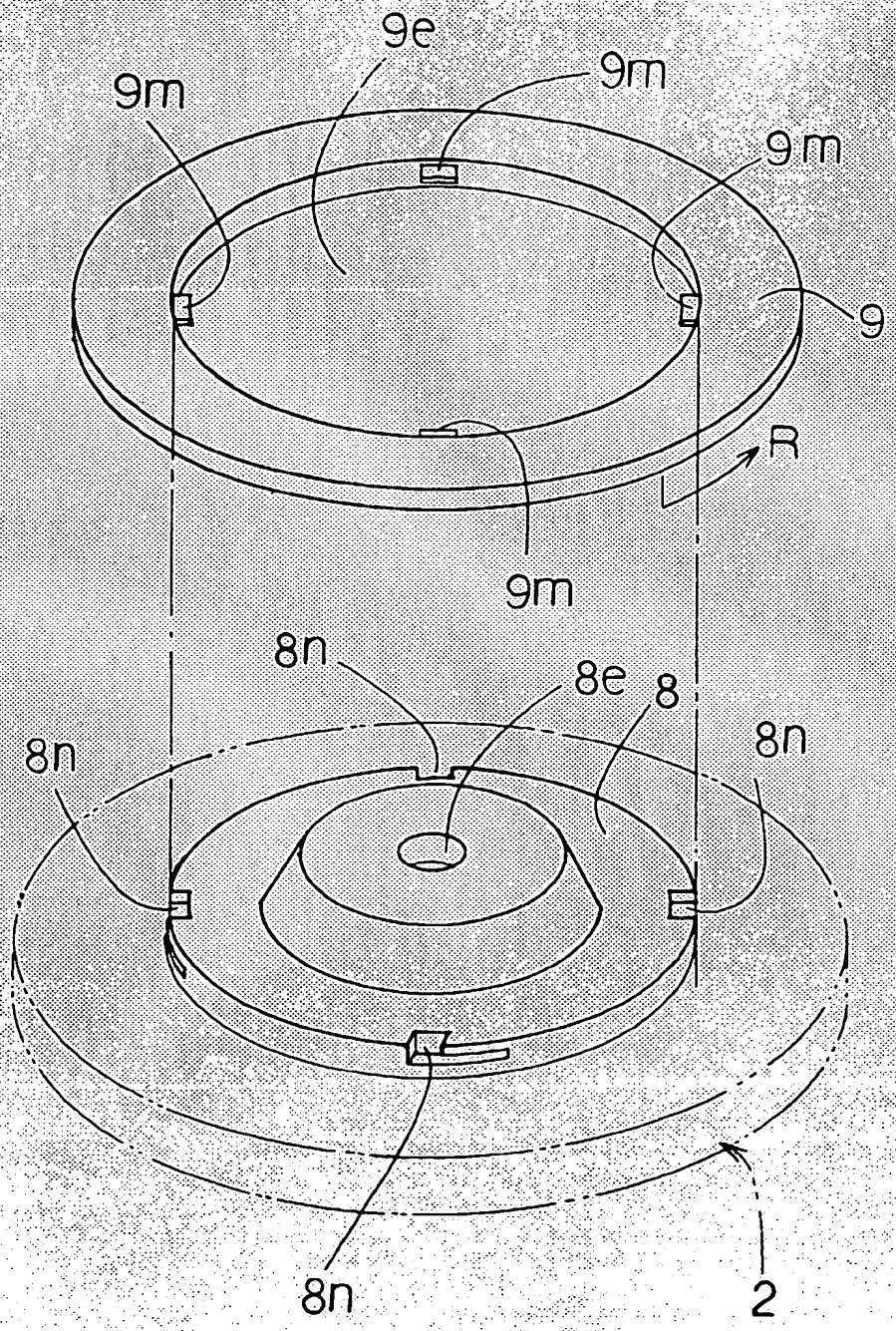


FIG. 21

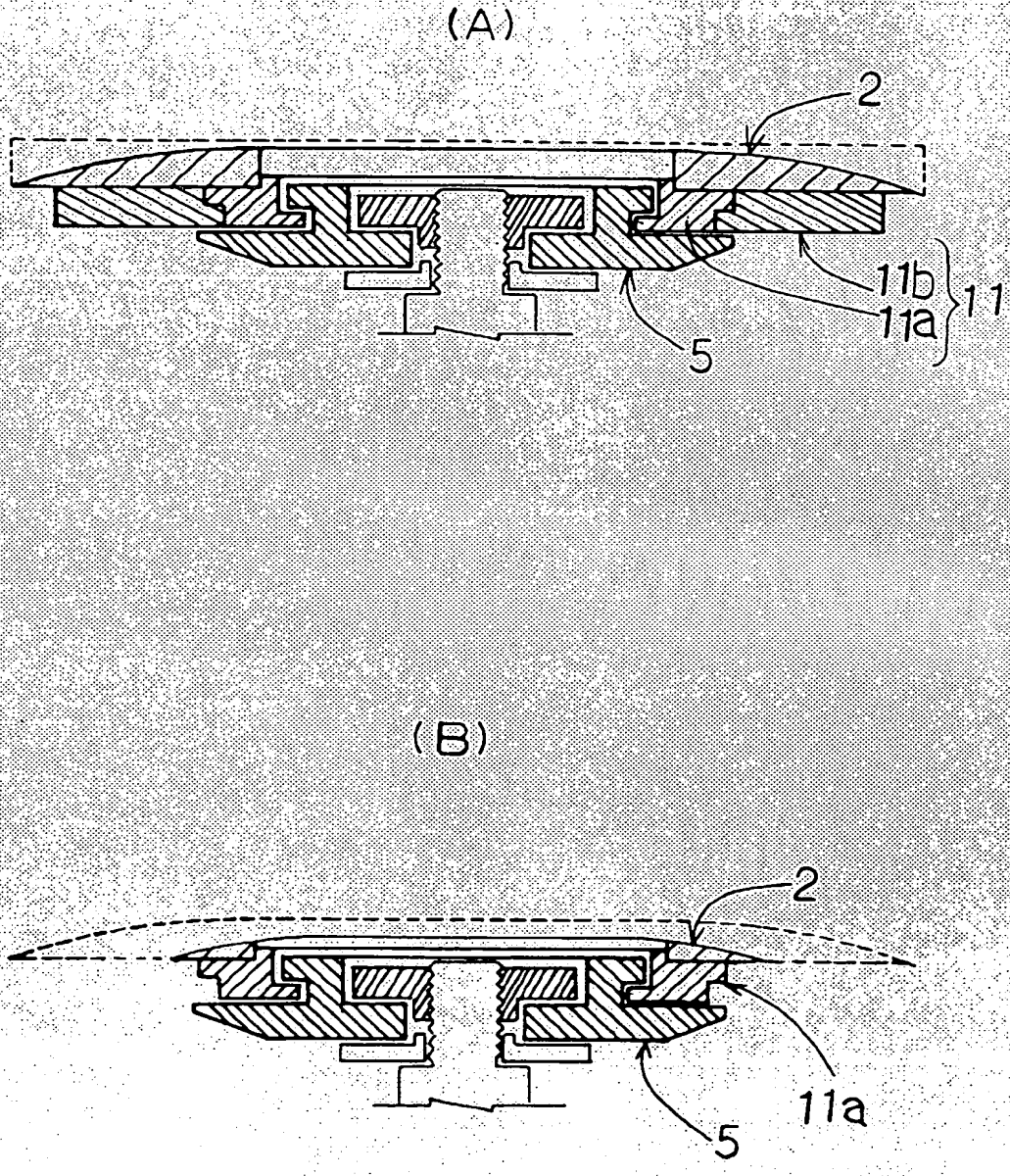
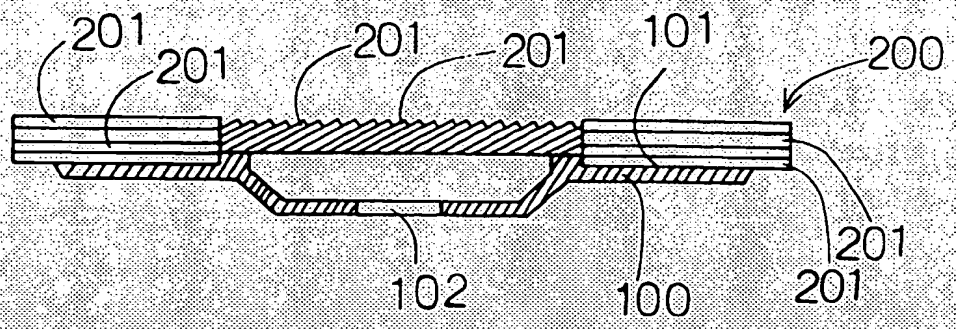


FIG.22
PRIOR ART

(A)



(B)

